CIVIL ENGINEERING

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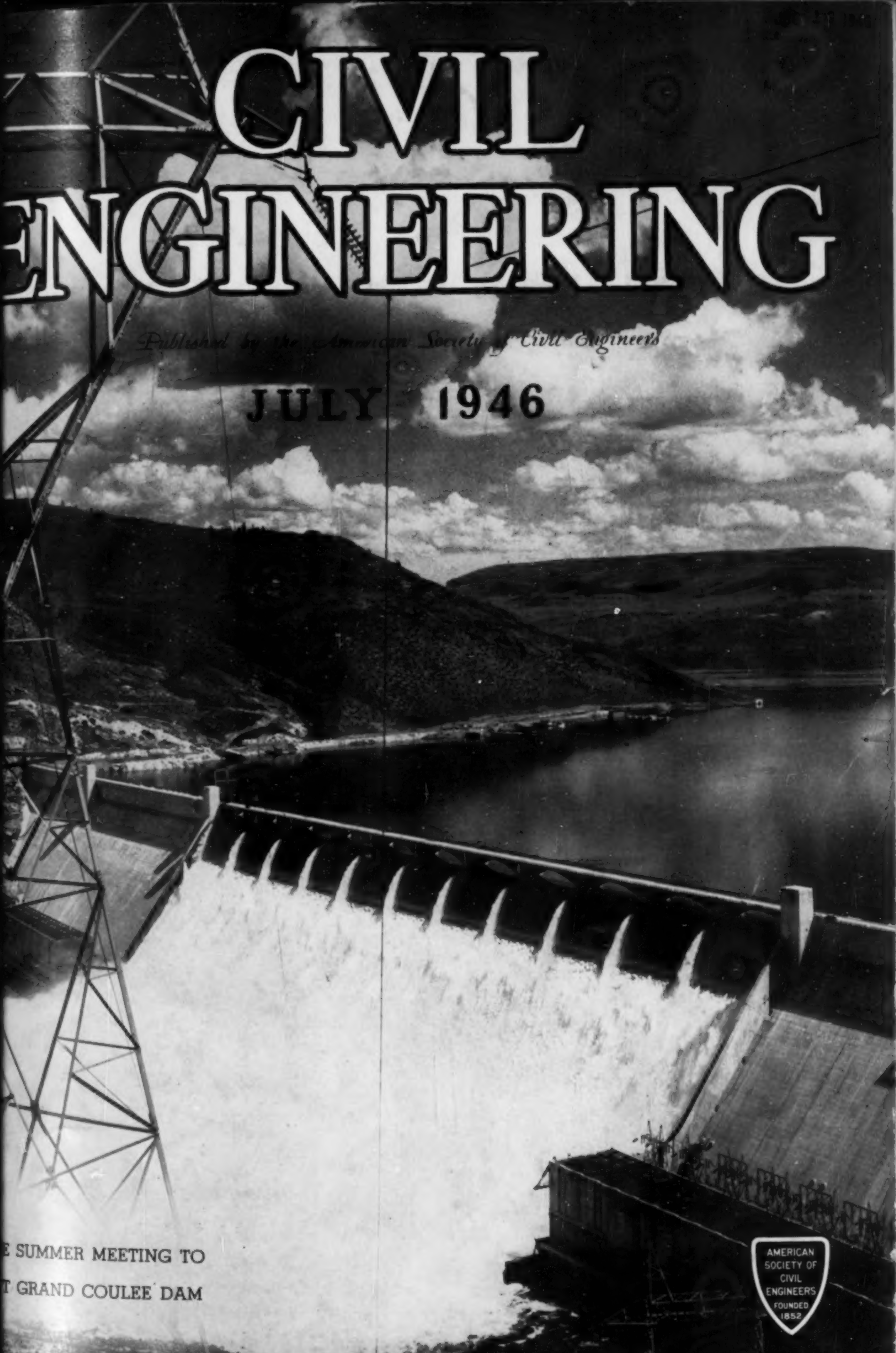

E SUMMER MEETING TO
T GRAND COULEE DAM

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

Among Our Writers

C. H. Giroux (U. of Colo., B.S. in E.E. '12) was with General Electric from 1912 to 1923 in the Testing, Railway, Marine Eng., and Construction Eng. departments, then with the Corps of Engineers until 1943. Since that year he has been special asst. to the Chief of Engineers as consultant on electrical and mechanical engineering problems.

Myron A. Swayze (Case School of Applied Science, B.S. in Ch.E. '12, Ch. Engr. '21), the Director of Research of the Lone Star Cement Corp., has been active in committee work for the A.S.T.M. in connection with his specialty, cement. In 1942 he received the Wason Medal of the Am. Concrete Inst. for noteworthy research. In 1945 he was sent to Europe by the U.S. Foreign Economic Admin. as scientific consultant to survey Germany's cement industry.

Karl R. Kennison (Colby Col., A.B. '06; M.I.T., B.S. '08) following work as asst. to John R. Freeman, Hon. M. ASCE, and for the Providence Water Supply Board, became head of the Emergency Fleet Corp.'s construction and maintenance work in New Orleans, Mobile, and Pensacola. From 1920 to 1926 he was a consulting engr. in Boston. Since 1926 he has been with the Metropolitan Dist. Water Supply Commission, for the past 7 years as chief engr.

Charles E. DeLeuw (U. of Ill., B.S. in C.E. '12, C.E. '16) began his career as an engr. in private practice shortly after World War I, in which he served as Captain, Fourth U.S. Engineers. His experience includes transit developments in many large cities as well as traffic, highway, and railroad projects. He was Chief Engr. in charge of the initial subway construction in Chicago. He is president of DeLeuw, Cather & Co.

American Society of Civil Engineers Founded 1852

Volume 16 Number 7

July 1946

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Member Audit Bureau of Circulations

The President Says . . . .

To: The Members of the American Society of Civil Engineers:

Engineers Joint Council has performed another major public service through the report by its National Engineers Committee on the "Industrial Disarmament of Japan."

Because this and the previous report on Germany have received much attention in the public press, other phases of the Joint Council's program are overshadowed, and many of our members have not understood that Council is actually carrying on other and important work, much of which is closely related to their profession and to their personal affairs.

Engineers Joint Council is your agency for the work of coordinating the interests of the members of the five older and larger engineering groups—the Civil, Mechanical, Electrical, Mining, and Chemical Engineers—and as to one program, that of the economic status of the engineer, the interests also of the members of the National Society of Professional Engineers.

Under its present 5-Point Program, it is concentrating into one major study, matters critical to the future of the engineering profession, such as service to the public in national and international affairs, service to the profession in developing its ultimate unity and improving the social and economic position of its members.

What Council is doing and what it may do in the future needs now the sympathetic and constructive examination by the individual members of all its sponsoring groups, and if it is to carry on, needs also their individual support.

It seems to me that this can best be accomplished through our Local Section organizations, and I propose to ask the Local Section officers if they will not make this matter a major item on their first fall program.

I solicit your earnest interest and cooperation in the discussions which are to be scheduled.

Sincerely yours,

W.W. Horner
President

W. W. Horner
President

William N. Carey
Secretary and Executive Officer

Sydney Wilmot
Editor in Chief and Manager of Publications

Don P. Reynolds
Associate Editor

CIVIL ENGINEERING

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Volume 16 — July 1946 — Number 7

To Spokane for the 74th Annual Convention, July 17–19

PLEASURE will be interspersed liberally with business when the three-day seventy-fourth midsummer Annual Convention of ASCE opens in Spokane, Wash., July 17, it is evident from the program which has been completed by General Chairman Thomas H. Judd and his hard-working committeemen.

In addition to the technical sessions, social gatherings have been arranged, as has an excursion to Grand Coulee Dam on the Columbia River, on which sightseers will view this largest man-made structure in the world.

TECHNICAL SESSIONS

The Davenport Hotel is to be the scene of the Convention. Here seven of the Society's Technical Divisions will cooperate in presenting informative papers on timely subjects. Because of the special interests of the region, emphasis will be on irrigation, power, and other water-use topics. The Power and Irrigation Divisions will hold separate and joint sessions, and in addition the Power Division will hold a joint session with the Hydraulics Division. Other Divisions scheduled to conduct meetings are the Highway, Sanitary Engineering, Structural, and Waterways groups. A detailed schedule of subjects, speakers, and times is presented in the Convention program on the following pages, as are other highlights of the planned social functions.

MANY SPECIAL FEATURES

For the opening ceremonies, outstanding speakers are scheduled. President W. W. Horner will deliver his Annual Address, and a discussion of national reclamation policies will be presented.

After two days of technical and business meetings, coupled, of course, with social gatherings, the Convention will be concluded with the ninety-mile trip to Grand Coulee Dam on Friday. The scenic wonders of the journey to the dam are certain to be long remembered. Befor descending to the dam proper, the highway skirts the edge of the plateau, so sightseers can enjoy a magnificent view of the entire project, including the dam and lake, towns, and power lines. With the cooperation of the U.S. Bureau of Reclamation, the conducted tour will include inspection of outstanding features of the structure.

Entertainment at the site will feature lectures in the grandstand, a showing of a construction model at the west vista house, and a tour of the power house. Every opportunity will be given visitors to become thoroughly acquainted with the project.

Special entertainment for women visitors has been arranged by a Ladies' Committee.

Preceding the Convention, the quarterly meeting of the Board of Direction will be held July 15 and 16, with committee meetings scheduled to start the preceding week-end.

Spokane, Host City to Annual Convention of ASCE

Seventy-Fourth Annual Convention in Spokane, Wash.

Hotel Davenport to Be Headquarters, July 17–19, 1946

General Meeting—Wednesday Morning

9:00 Registration on Mezzanine
ISABELLA ROOM

10:00 Annual Convention Called to Order by
HAROLD J. DOOLITTLE, M. ASCE, President, Spokane Section, ASCE

10:10 Address of Welcome
HON. ARTHUR R. MEEHAN, Mayor of the City of Spokane

10:30 Response
W. W. HORNER, President, American Society of Civil Engineers

10:40 Annual Address
W. W. HORNER, President, American Society of Civil Engineers

11:20 Address on National Reclamation
JOHN W. HAW, Director, Agricultural Development Department, Northern Pacific Railway, St. Paul, Minn.

12:00 Business Meeting

12:20 Adjournment

12:30 Luncheon—Marie Antoinette Room
Address on "Fur Traders and Furnaces"
W. WALTER WILLIAMS, President, Continental Inc., Seattle, Wash.
Ladies, members of the Associated Engineers of Spokane, and guests are cordially invited to attend.
Tickets $1.50 each.

Entertainment for Ladies—Wednesday Afternoon

At the close of the morning session the ladies will attend the Luncheon at 12:30 p.m. in the Marie Antoinette Room of the Davenport Hotel. Following the luncheon, W. Walter Williams of Seattle will address the luncheon group on "Fur Traders and Furnaces."

Following the luncheon the ladies will assemble in the lobby of the Davenport and under the leadership of Mrs. T. H. Judd, the group will proceed to the Spokane Museum, where a book review and other entertainment is planned, followed by refreshments.

There is no charge for tickets.

GRAND COULEE DAM, SHOWING GOVERNMENT TOWN AT THE LOWER RIGHT

Little Falls on Spokane River

Generators, West Power House, Grand Coulee Dam

Technical Division Sessions—Wednesday Afternoon

Sanitary Engineering Division

Elizabethan Rooms D and E

George J. Schroepfer, Chairman, Executive Committee, Sanitary Engineering Division, Presiding

2:30 **Proposed Sewage Works at Portland, Ore.**

Ben S. Morrow, Assoc. M. ASCE, City Engineer, Portland, Ore.

Discussion by

John W. Cunningham, M. ASCE, Consulting Engineer, Portland, Ore.

3:10 **Stream Aeration**

Richard G. Tyler, M. ASCE, Professor of Sanitary Engineering, University of Washington, Seattle, Wash.

3:50 **Proposed Plans for Pollution Abatement on the Willamette River**

Fred Merryfield, M. ASCE, Professor of Civil Engineering, Oregon State College, Corvallis, Ore.

Irrigation Division

Isabella Room

H. D. Comstock, Chairman, Executive Committee, Irrigation Division, Presiding

2:30 **The Columbia Basin Project**

Frank A. Banks, Assoc. M. ASCE, Supervising Engineer, U.S. Bureau of Reclamation, Coulee Dam

Discussion by

H. A. Parker, Irrigation Engineer, U.S. Bureau of Reclamation

3:10 **Evolution of Irrigation in Alberta**

Augustus Griffin, M. ASCE, Manager, Department of National Resources, Canadian Pacific Railway, Calgary, Alberta, Canada

Discussion by

Robert S. Stockton, M. ASCE, Consulting Engineer, Thompson Falls, Mont.

George N. Carter, M. ASCE, District Engineer, U.S. Bureau of Reclamation, Boise, Idaho.

W. C. Muldrow, Assoc. M. ASCE, Engineer, U.S. Engineer Office, Portland, Ore.

3:50 **Irrigation West of the Cascades**

Lee McAllister, M. ASCE, Engineer, U.S. Bureau of Reclamation, Salem, Ore.

Discussion by

Charles J. Bartholet, M. ASCE, Consultant, Department of Conservation and Development, State of Washington, Olympia, Wash.

William M. McGibbon, U.S. Engineer Department, Portland, Ore.

Power Division

Elizabethan Rooms B and C

Arthur T. Larned, Chairman, Executive Committee, Power Division, Presiding

2:30 **Results of Automatic Hydro-Station Operation**

S. O. Schamberger, Assoc. M. ASCE, Chief Engineer, New York Power and Light Corp., Albany, N.Y.

3:15 **Sand Traps in Open and Closed Conduits**

H. A. Burt, Assistant Superintendent, Hydroelectric Production and Transmission, Public Service Company of Colorado, Denver, Colo.

Dinner and Entertainment—Wednesday Evening

Hall of Doges and Marie Antoinette Room

6:30 Assembly—**Hall of Doges**
Cocktails

7:30 Dinner—**Marie Antoinette Room**

Following the dinner, there will be a showing of motion pictures of the scenic beauty and natural resources of the Northwest. Dean J. E. Buchanan of the College of Engineering, University of Idaho, will be master of ceremonies at the dinner.

Tickets, $4.50 each.

Dress will be informal.

COEUR D'ALENE LAKE

Technical Division Sessions—Thursday Morning

Highway Division

ELIZABETHAN ROOMS B AND C

Day Okes, Chairman, Executive Committee, Highway Division, Presiding

9:00 **Military Highway Transportation and Facilities**

COL. JOHN W. WHEELER, M. ASCE, Executive Assistant to the President, Chicago, Burlington and Quincy Railway Company, Chicago, Ill.

9:40 **Highway Construction and Our National Economy**

CHARLES M. UPHAM, M. ASCE, Engineer-Director, American Road Builders Association, Washington, D.C.

Waterways Division

EAST BANQUET HALL

Col. C. L. Hall, Chairman, Executive Committee, Waterways Division, Presiding

9:00 **Flood Control Problems in the Columbia River Basin**

O. E. WALSH, Colonel, Corps of Engineers, USA, District Engineer, Portland, Ore.

Discussion by

GAIL A. HATHAWAY, Vice-President, ASCE, Head Engineer, Corps of Engineers, Office of the Chief of Engineers, Washington, D.C.

M. L. NELSON, M. ASCE, Senior Civil Engineer, Corps of Engineers, USA, Head, Hydrology and Reports Section, U.S. Engineer Office, Portland, Ore.

9:40 **U.S. Engineer Department Review Report on the Columbia Basin**

C. P. HARDY, M. ASCE, Colonel, Corps of Engineers, USA; District Engineer, Seattle, Wash.

Discussion by

T. M. ROBINS, M. ASCE, Brigadier General, Corps of Engineers, USA, Retired; Consulting Engineer, Portland, Ore.

HON. C. E. WEBB, District Chief Engineer, Dominion Water and Power Bureau, Vancouver, B. C.

10:20 **Improvements of the Columbia River for Navigation**

R. E. HICKSON, M. ASCE, Head Engineer, U.S. Engineer Department, Portland, Ore.

Discussion by

A. J. GILARDI, M. ASCE, Portland, Ore.

Irrigation and Power Divisions—Combined Session

ELIZABETHAN ROOMS D AND E

H. D. Comstock, Chairman, Executive Committee, Irrigation Division, Presiding

9:00 **Stream-Flow Forecasting for Irrigation**

R. A. WORK, Irrigation Engineer in Charge of Snow Surveys; U.S. Soil Conservation Service, Medford, Ore.

Discussion by

FREDERICK H. PAGET, Assoc. M. ASCE, Associate Hydraulic Engineer, State Division of Water Resources, Sacramento, Calif.

WALTER JOHNSON, Hydrographer, Washington Water Power Company, Spokane, Wash.

10:00 **The Value of Storage for Power in the Columbia River Basin**

B. E. TORPEN, M. ASCE, Head Engineer, U.S. Engineer Department, Portland, Ore.

Discussion by

J. C. STEVENS, Past-President, ASCE, Consulting Engineer, Portland, Ore.

A. L. HENNY, M. ASCE, Engineer, U.S. Engineer Department, Portland, Ore.

Entertainment for Ladies Thursday Afternoon

Ladies will assemble in the lobby of the Davenport Hotel at 1:15 p.m. and go to the Spokane City Club for luncheon at 1:30 p.m. and an entertainment program.

Tickets, $1.50 each.

Technical Division Sessions—Thursday Afternoon

Hydraulics and Power Divisions—Combined Session

ELIZABETHAN ROOMS B AND C

C. P. Vetter, Chairman, Joint Committee on Sedimentation in Reservoirs, Presiding

Program arranged by the Joint Committee on Sedimentation in Reservoirs

2:00 **General Statement as to Problems Related to Reservoir Sedimentation**

CARL B. BROWN, Assoc. M. ASCE, Head, Sedimentation Section, Soil Conservation Service, Washington, D.C.

2:15 **Removal of Sediment from Reservoirs by Means of Density Currents**

HUGH S. BELL, Soil Conservation Service, California Institute of Technology, Pasadena, Calif.

2:50 **Procedure and Equipment Used for Suspended Sediment Sampling**

MARTIN E. NELSON, M. ASCE, Engineer, U.S. Engineer Office, St. Paul, Minn., and

PAUL C. BENEDICT, Assoc. M. ASCE, Associate Engineer, U.S. Geological Survey, Lincoln, Nebr.

3:20 **Motion-picture film by Mr. Bell on experiments conducted on density currents by the California Institute of Technology**

3:40 **General discussion**

Structural Division

ELIZABETHAN ROOMS D AND E

John I. Parcel, Member, Executive Committee, Structural Division, Presiding

2:00 **Some Lessons Learned from the Failure of the Tacoma Narrows Bridge and Its Redesign**

F. B. FARQUHARSON, M. ASCE, Professor of Civil Engineering, University of Washington, Seattle, Wash.

2:30 **Unusual Problems in the Design of the Proposed Tacoma Narrows Bridge**

C. E. ANDREW, M. ASCE, Consulting Engineer, Washington Toll Bridge Authority, Tacoma Narrows Bridge, Tacoma, Wash.

Discussion by

DEXTER R. SMITH, Designing Engineer, Washington Toll Bridge Authority, Tacoma, Wash.

2:45 **Motion Picture of aerodynamical experiments performed by Professor Farquharson at the University of Washington**

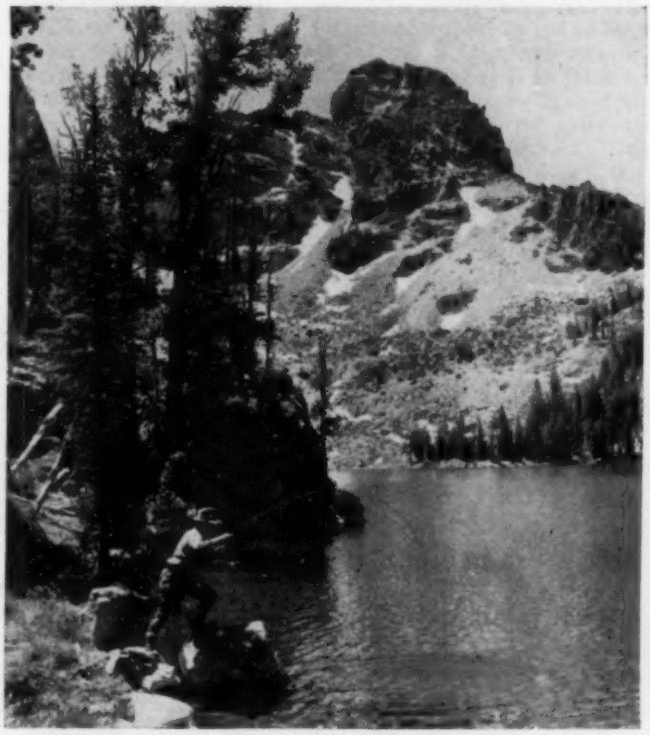
3:15 **General discussion**

Sightseeing and Dinner Thursday Evening

Members, ladies, and guests will assemble in the lobby of the Davenport Hotel at 6:00 p.m. and go by bus for a sightseeing tour of Spokane. This trip will cover some of Spokane's many parks, residential districts, scenic drives, and other points of interest. The trip will end at the Spokane Country Club, where a buffet dinner will be served amid the pines. Following the dinner the party will return to the Davenport Hotel.

Tickets $4.00 each.

MOUNT SPOKANE—ELEVATION 5,800 FT.



SHEEP CREEK LAKE IN IDAHO

Excursion to Grand Coulee Dam—All Day Friday

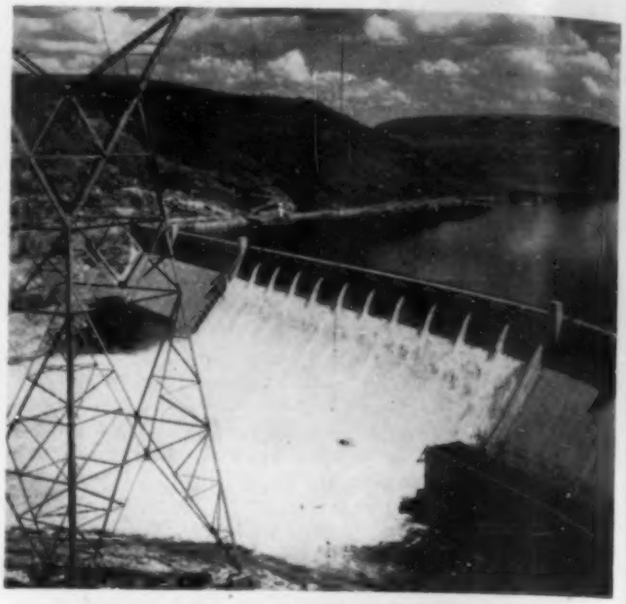
Members, ladies, and guests will assemble at 9:00 a.m. at the Davenport Hotel, where they will board buses for the 90-mile trip to Grand Coulee Dam. As the tour leaves Spokane and rises to the summit of Sunset Hill, a beautiful panorama of the city may be seen. A few miles further the highway reaches the plateau and in the distance on the left may be seen Geiger Field, home of the Army Aviation Engineers and jointly used as Spokane's newest municipal airport. Beyond this point a few miles the route passes the Spokane Army Air Depot at Galena, also on the left side of the highway. This depot is one of the largest aircraft repair bases in the United States, employing several thousand people during the war and still on active status.

The ensuing landscape along the drive is primarily grazing land for herds of sheep and cattle and thus has little to offer in scenic beauty. However, similar barren country will be transformed into thousands of acres of valuable agricultural land with the advent of irrigation water from Grand Coulee.

As the trip draws closer to its destination the highway circles to the edge of the plateau, and immediately a magnificent view of the huge Grand Coulee of the Columbia River is presented. From this point may be seen the dam and lake, towns, power lines, etc., that make up this great project. The route then winds down to the Coulee and brings the guests to the scene of the dam.

Arrangements have been made with the Bureau of Reclamation, through Frank A. Banks, Supervising Engineer, to provide guides and descriptive literature concerning the Columbia Basin Project and the Grand Coulee Dam.

Identical luncheons will be served at two restaurants, the Green Hut on the west side and the Coffee Shop on the east side. Approximately 50 persons can be accommodated in 45 minutes at each location. The luncheon schedule will be adjusted to the lectures in the grandstand, the showing of a construction model at the west vista house, and visits of parties of about 60 to the power house at intervals of 15 minutes or more. Everyone will have an ample opportunity to see all that he may desire regardless of the luncheon schedule. Upon conclusion of the tour and inspection, the party will return to Spokane.



POWER TRANSMISSION TOWER OVERLOOKING GRAND COULEE DAM

Transportation bus tickets, $3.50 each.

Luncheon tickets, $1.00 each.

Hotel Accommodations and Announcements

Hotel Accommodations

The Davenport Hotel is Convention Headquarters and a block of rooms has been set aside for the accommodation of members. The rates at the Davenport range from $4.00 up for double rooms and $3.00 up for single rooms, with bath. Requests for reservations should be made directly to the Davenport as far in advance as possible, stating that the reservation is for attendance at the ASCE Convention. In case the hotel is unable to fill requests because of lack of rooms, attempt will be made to make reservations at nearby hotels.

Confirmation of reservations will be made direct, by the hotel.

Information

An Information Desk will be provided in the Headquarters Hotel to assist visiting members in obtaining desired information about the city. At the registration desk a card file of those in attendance will be maintained, with information as to Spokane addresses. Efforts will be made to deliver telegrams and messages promptly. Any mail for members received at Headquarters during the Convention will be delivered to the hotel address, if known; otherwise it will be held at the Information Desk. Letters undelivered at the close of the Convention will be forwarded to the latest mailing address.

Entertainment for the Ladies

Attention is directed to the entertainment provided for the ladies. It is expected that they will participate with the members in any other features of the program in which they are interested.

Local Sections Conference, Monday and Tuesday, July 15 and 16, 1946

A conference of representatives of Local Sections will be held at 10:00 a.m. on Monday and Tuesday, July 15 and 16, 1946, at the Hotel Davenport. The program will schedule topics of professional rather than technical interest, in which all representatives are expected to participate. All members of the Society are welcome to attend.

During the week of the Convention, ASCE officers and directors will address the following Spokane organizations:

PRESIDENT W. W. HORNER—Spokane Chamber of Commerce, noon, Tuesday, July 16.
PAST-PRESIDENT J.C. STEVENS—Spokane Society of Professional Engineers, noon, Thursday, July 18.
DIRECTOR O. H. KOCH—Kiwanis Club, noon, Thursday, July 18.
DIRECTOR WILLIAM D. SHANNON—Rotary Club, noon, Thursday, July 18.
DIRECTOR H. F. Thomson—Lions Club, noon, Thursday, July 18.

Glacier National Park

Local Committees on Arrangements

GENERAL

Thomas H. Judd, General Chairman
Harold J. Doolittle, President, Spokane Section
William P. Hughes, Vice-President, Spokane Section
C. Rea Moore, Vice-President, Spokane Section
William A. Hill, Secretary-Treasurer, Spokane Section

ENTERTAINMENT

E. H. Collins, Chairman
C. Rea Moore
Lloyd George
Walter L. Woodward

HOTEL AND REGISTRATION

Elton L. Haines, Chairman
Homer C. Bender
Fred M. Goldsworthy
Allen S. Janssen
Emmett Moore
Harold J. McCoy
Kenneth P. Norrie

FINANCE

C. A. Burnette, Chairman
William A. Hill
Lloyd George

PROGRAM

W. L. Malony, Chairman
Charles L. Barker, Technical Program
Fred H. Rhodes, Jr., Seattle Section
James C. Dalton
H. Loren Thompson, Oregon Section
Fred M. Veatch, Tacoma Section
William T. Eiffert

PUBLICITY

Robert E. Tobin, Chairman
John C. Breedlove

RECEPTION

Arthur C. Nauman, Chairman
Jesse E. Buchanan
Charles E. Davis
William P. Hughes
Howard E. Phelps
George E. Swannack, Jr.
Arthur J. Turner

COULEE DAM EXCURSION

Frank A. Banks, Chairman
S. E. Hutton, Vice-Chairman
Frederick M. Berry
Luther E. Cliffe
Leonard V. Downs
Phillip E. Ehrenhard
Bert A. Hall
Edwin Nasburg
H. A. Parker
Roger R. Robertson
Verney W. Russell
Fred J. Sharkey
Ross Tiffany
Roy B. Williams

TRANSPORTATION

Phil G. Holgren, Chairman
J. Byron Barber
Albert I. Buchecker

LADIES

Harold J. Doolittle, Chairman
Mrs. T. H. Judd, Vice-Chairman
Mrs. F. A. Banks
Mrs. J. B. Barber
Mrs. C. L. Barker
Mrs. H. C. Bender
Mrs. J. C. Breedlove
Mrs. J. E. Buchanan
Mrs. A. I. Buchecker
Mrs. C. A. Burnette
Mrs. E. H. Collins
Mrs. C. E. Davis
Mrs. H. J. Doolittle
Mrs. W. T. Eiffert
Mrs. F. M. Goldsworthy
Mrs. E. L. Haines
Mrs. W. A. Hill
Mrs. W. P. Hughes
Mrs. P. G. Holgren
Mrs. W. L. Malony
Mrs. H. J. McCoy
Mrs. C. Rea Moore
Mrs. Emmett Moore
Mrs. K. P. Norrie
Mrs. H. E. Phelps
Mrs. R. E. Tobin
Mrs. A. J. Turner
Mrs. W. L. Woodward

Hotel Davenport, Convention Headquarters

Program for Industrial Disarmament of Japan Proposed by EJC

State, War, and Navy Departments Consider National Engineers Committee Report

By Allen Wagner

A second major contribution of the engineering profession toward lasting peace—a comprehensive report on how to disarm Japan industrially while at the same time permitting the non-war potential section of her industry to function safely on a free-enterprise basis—has just been submitted to the State, War, and Navy departments.

A product of the National Engineers Committee of Engineers Joint Council, the report and its technological, nonpolitical recommendations are expected to be deemed as useful in the creation and administration of policy covering control of Japan as the predecessor report of the same group, submitted late in September of 1945, was found to be in the industrial control of Germany.

Prominent in the preparation of both the German and Japanese reports were two ASCE members, Malcolm Pirnie, Past-President, and Col. Carlton S. Proctor, both of New York. Colonel Proctor was chairman of the National Engineers Committee, and Mr. Pirnie chairman of the Engineers Joint Council Executive Committee.

Engineers Joint Council is comprised of the presidents, junior past-presidents, and secretaries of: American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers, and American Institute of Chemical Engineers.

A Peaceful Japan Outlined

After the report on Germany was promulgated by these representatives of organizations made up of nearly 100,000 engineers, the Secretaries of State, War, and Navy were profuse in their thanks. The National Engineers Committee was reconstituted last winter when the State Department requested "an examination of the question of industrial disarmament of Japan."

In transmitting the report to the State, War, and Navy departments, which, in turn, have dispatched copies of it to General of the Armies Douglas MacArthur in Tokyo, the engineering committee stated it did so, "encouraged by the fact that substantially all the recommendations of its report on Germany were included in the directive of the Allied Control Council of March 29, 1946, for the limitation and control of German industry."

Sixteen working committees, composed of American engineering and technological specialists in their respective fields, all of them highly placed in American industry, cooperated in the preparation of the report, which recommends that administrators of Japan should:

Prohibit the production of synthetic liquid fuels
Prohibit the production of aluminum and magnesium
Prohibit the use of nuclear energy
Limit and control the synthetic fixation of nitrogen
Limit and control the production of sulphuric acid and calcium carbide
Limit and control the capacities and production of steel and steel products plants
Limit the capacities and production of copper
Control production of coal and limit storage capacity for petroleum products

The recommended prohibitions, limitations, and controls, the report points out, will reduce the total Japanese peacetime labor force only by about five per cent and "there should be no serious problem in the reemployment of such a small percentage of labor in Japan's peacetime agriculture and consumer goods industries."

Asserting that "any plan which is to be effective must be simple and direct in operation, not unbearably oppressive to the common people, and not repugnant to fair-minded and liberty-loving people of the world," the report points out that the engineers who prepared it considered the following fundamental factors:

The psychology of the Japanese people
The extent and limitation of Japan's natural resources particularly significant for war
The control of industrial facilities for processing and manufacture
The effect of controls upon national economy and standards of living
The will of the controlling nations to perpetuate their supervision

"The plan proposed must be firm but also just," the report states. "The complete elimination of Japanese industry, leaving the nation to eke out a living on agriculture and fishing, if possible, would create social chaos and suffering of such magnitude that enforcement would be impossible, and world opinion would repudiate the action."

The report points out that in the pursuit of her ambitions for empire expansion, Japan had succeeded in suppressing the industrial strength of her neighbors as she had built up her own, and asserts:

"The destruction of her aggressive power and control of her potentials for future war will be insufficient, therefore, without the simultaneous development of industry, agriculture, and trade in and among the neighbors of the Japanese islands. The question of setting and enforcing regulations pertaining to Japan proper, which will harmonize with policies adopted toward countries liberated from Japan's domination, should receive careful consideration. With respect to both export and import, the economies of various nations or districts have been interrelated, and each new situation will present problems involving market outlets, employment, means of obtaining necessary supplies, and preservation of invested capital in countries outside of Japan. If Japan's markets are wholly and prematurely closed before others are developed, violence may be done to the industrial economies of nations formerly dependent upon such outlets."

The engineers made a study of Japanese commerce, industry by industry, and in all cases sought to ascertain the extent of the industries prior to Japan's embarkation on her campaign of aggression.

Among the conclusions reached and recommendations made are the following:

More than two-thirds of the recent production of steel in Japan was for war purposes, for her average peacetime steel consumption for the 1926–1930 period was 1,539,000 metric tons of rolled products, as against a swollen potential productive capacity of approximately 9,000,000 metric tons at war's peak. It is recommended that an annual production of 1,600,000 metric tons of finished rolled steel products be permitted as well as an annual production of 1,500,000 metric tons of blast-furnace iron and 500,000 metric tons of foundry iron per year by the blast furnaces for castings. It is further recommended that there be permitted the annual production of 230,000 metric tons of electric-furnace steel ingots and that permission for importation of scrap for steel-making purposes be held in abeyance until the situation is more clearly defined and the needs of the industry can be better determined.

Pointing out that Japan's aluminum production skyrocketed from 7,000,000 pounds in 1935 to 243,000,000 in 1944, the report estimates that "the amount of

aluminum needed by postwar Japan for its peacetime requirements" is between 10,000,000 and 15,000,000 pounds per year. It is recommended, in view of the fact that "the amount of employment involved in the production of this quantity of aluminum would be negligible in its effect upon Japan's economy, as the total employment would be only about 250 or 300," that all aluminum required for peacetime use be imported.

"It is believed that, subject to control, Japan may safely be allowed to import such aluminum as may be needed for civilian products, provided the fabricating facilities are limited in size and capacity for those needed for such civilian products," the report states.

It was recommended further that all aluminum smelting plants within the borders of postwar Japan be eliminated by either demolition or removal, and that importation of bauxite or any aluminous ores be prohibited except for a limited amount to be used as such for other than smelting of aluminum.

The magnesium industry was found by the National Engineers Committee to have paralleled the aluminum industry. Where 700,000 pounds were produced in 1935, 10,600,000 pounds were produced in 1944 and, the report states, "it is obvious that the Japanese magnesium production was developed only in connection with her war management." It is recommended that all Japanese magnesium production facilities suffer the same fate as that prescribed for the aluminum industry and that her essential peacetime needs for magnesium chemicals be supplied from domestic raw materials through electric power requirements so controlled as to prevent metal production.

Other Metals

Although copper production averaged more than 150,000 tons per year in the later war years, the engineers estimate peacetime requirements at scarcely more than half that quantity and recommend that "copper smelting and refining capacities in excess of 85,000 metric tons be eliminated to provide for a peacetime allowance of 70,000 metric tons per year."

Lead production is cut back to its prewar status of 17,000 metric tons annually despite the fact that the average annual production from 1935 to 1944 was 78,000 metric tons.

Present refinery capacity of 178,600 metric tons of zinc per year should be reduced, the report says, "to about 40,000 tons, which would then be in approximate balance with the mine production of 30,000 tons as reported for the year 1943."

Machine tools installed in the arsenal and aircraft plants would be eliminated under the plan, together with those in industry establishments which have functioned mainly in support of Japan's war potential. Production of 20,000 to 25,000 units per year is estimated not to exceed the annual replacement requirements when peacetime industry is well under way.

Vital Chemicals Restricted

Nitrogen, of vital importance to Japan in meeting food requirements of her large population, which depends primarily upon chemical fertilizers, also is the basic element of all military explosives, except the atomic bomb, and therefore posed a difficult problem. The report recommends that the wartime output of 560,000 metric tons of nitrogen be reduced to 180,000 metric tons in future, "of which 90,000 tons shall be produced as calcium cyanamid and the remainder supplied by synthetic ammonia plants," preferably those using hydroelectric power for production of the necessary hydrogen, thus permitting additional controls. It is further recommended that "Japanese citizens and nationals, corporations, or the Japanese government or any agents thereof be prevented from obtaining complete or partial control of any financial interest in any nitrogen fixation plant in any other countries."

In dealing with sulphuric acid production, the engineers point out that limitation of direct war potential in its manufacture is not in itself a difficult undertaking, but that speed is essential in the carrying out of intelligent integration of sulphuric acid manufacture with the capacity of permissible consuming industries, particularly fertilizers, "if widespread starvation, through shortages of fertilizers, is to be avoided." The recommendation is that production of oleum and fuming sulphuric acid should be eliminated as a war hazard and all production capacity dismantled or, if found essential for certain restricted uses, such production be specifically licensed. Adequate safeguards are recommended to be instituted to control the manufacture of the 3,000,000 tons of sulphuric acid deemed necessary for peacetime use, and that plant capacity to produce more than this amount be eliminated.

In the fuel industry, the recommendations are that:

The coal industry of Japan be placed under a control system which will provide for domestic heating and the needs of the metallurgical, manufacturing, and transportation industries of a peacetime economy and for the prescribed level of exchange of exports and imports;

The total storage capacity of the various grades of petroleum be reduced to a figure of from 6 million to 7 million barrels (Japan's pre–Pearl Harbor storage capacity was estimated at 55,000,000 barrels);

Imports of petroleum for peacetime purposes be so controlled that there shall not be at any time surplus beyond that provided in such storage; and

Synthetic oil plants operating on the hydrogenation or gas synthesis process be destroyed and that the Japanese be forbidden to work on these processes or their development.

Supervision of Power Essential

The engineers also advocated drastic supervision over and curtailment of electric-power supply, which is termed "one of the simplest ways to control industrial production." On-the-spot surveys of various industries and industrial plants and civilian needs are recommended in determining the reductions to be effected.

Japanese research and development on items for military application should be absolutely debarred, the report declares, and existing laboratories which have served the war purpose primarily should be dismantled or adapted to peacetime projects. "No new ones shall be started and severe penalties imposed for any attempted evasion of these regulations."

On nuclear energy, the report states:

"The complete elimination and prohibition of all activities relating to research and development on the manufacture of atomic weapons, and in connection with all phases of nuclear energy, must be rigidly enforced as the first essential of any program for the disarmament of Japanese war potential industries."

Control and regulation of future construction is advocated and supplemental controls are urged with simplified import licensing in connection with all war-potential materials.

In concluding their report, the National Engineers Committee warn that:

"These recommended procedures are not intended as a substitute for the protection afforded by an adequate police force of the United Nations in Japan. Freedom from fear of rearmament will be attained only as long as such a police force remains in authority. For the guidance and direction of the policing forces, there should be established a group of technological specialists who will keep informed as to Japanese industrial and research activities."

Signing the report, in addition to Colonel Proctor, were:

H. Foster Bain, consulting mining engineer, New York; Charles W. E. Clarke, vice-president, United Engineers and Constructors, Philadelphia; Sidney D. Kirkpatrick, editor, Chemical and Metallurgical Engineering, New York; Harry S. Rogers, president, Brooklyn Polytechnic Institute; and R. E. Zimmerman, vice-president, U.S. Steel Corporation, New York.

Radar Shows Promise in Mapping

PRECISION radar applications which can map large areas with both speed and accuracy have recently been made public information by military authorities. To actively promote application of new electronic apparatus to surveying problems, the ASCE Surveying and Mapping Division held a special conference in New York inviting contributions by experts of Army, Navy, and civilian organizations. The following symposium, giving particular attention to shoran and loran, was prepared from the transcript of the meeting and has just been released for this publication.

Part I. New Ease in Charting Positions

By Philip Kissam, M. ASCE

Chairman, Surveying and Mapping Division, ASCE

THE data that maps display are obtained by various surveying procedures which have become somewhat standarized but are certainly wide-open for improvement, since at best, and despite ingenious shortcuts, they are expensive, hand-operated, and very slow. The superb advances in speed developed during the war are a great credit to the abilities of the men who produced them, but detailed mapping is still a difficult and arduous procedure.

To be of greatest use, the simplest map must show not only an infinite quantity of accurate detail but it must also give exact positions with respect to the standard geographic coordinate system. Probably new features will appear on maps. For example, it is not difficult to forecast that accurate charting of the gravity and magnetic fields will assume new importance. If radar can simplify any of these procedures, the saving will be striking.

Radar and its derivatives have produced timing devices of such accuracy that distances can be measured by the elapsed time necessary for electromagnetic waves to traverse them. Sending apparatus has been developed which will produce waves short enough to avoid the difficulties of defraction but at the same time long enough to penetrate conditions which impede light. Such sensitive receivers exist that reflections of these waves can be recorded from objects hundreds of miles distant. Interference patterns of these short waves can be established which provide an invisible graticule upon which positions can be instantly determined and recorders have been developed which can count these waves with unheard-of rapidity.

It would seem that with these devices the surveyor could find a means of triangulation by traveling in a car, airplane, or ship, or by observing from a stationary position, and that the exact orientation and ground coordinates of an aerial photograph could be determined at the moment of exposure, or that the boundaries of a property could be measured, where the obstructions prevent lines of sight, merely by visiting the corners.

It appeared, however, that these possibilities could be realized only if men who knew mapping and men who knew radar could be brought together. This thought led to the organization of the Radar Conference of the Surveying and Mapping Division. This conference accomplished the following results:

1. An exchange of information
2. A discussion of the possibilities that this information may disclose
3. An outline of procedures for research

Part II. Application of Radar Equipment to Electronic Surveying

By Fletcher G. Watson

EXISTING electronic devices, as discussed in this symposium, were designed and constructed for a variety of military uses, but not for surveying, and in this new application they will necessarily be imperfect. Through experimentation their potentialities for electronic survey work can be better defined, and the desirable characteristics of the ultimate special surveying devices can be better specified. It is probable that the precision obtainable with special equipment developed from existing military devices can be increased as much as tenfold.

In attempting to evaluate the relative advantages and disadvantages of the various types of equipment and various principles to be applied in electronic surveying, it is extremely important to maintain a realistic balance between the accuracy required, or desired, over a certain range of distances, and the amount of effort and expense that can be justified by the result. Among the many surveying problems that can be undertaken with electronic equipment, there are a sizable portion for which the ultimate value of the results probably does not justify the use of elaborate or complicated machines. It appears axiomatic that the least expensive and least complex gear that will produce a satisfactory accuracy for a given arc will be used. Therefore, in approaching this new field, surveyors should specify the precision required for arcs of various lengths. Electronic engineers can then produce equipment of the simplest design and operation to satisfy these minimum requirements. This does not preclude the development of several devices with differing precision by which an arc can be measured with results similar to first-order, second-order, and third-order triangulation.

Basically there are two types of electrical equipment that can be used in survey work. Pulsed equipment, exemplified by shoran, loran, and all the radar sets, is new—a product of wartime research—and has a number of advantages. There remains, however, the possibility of using some type of continuous-wave equipment to set up patterns of standing waves by which an arc of modest length, a few miles, can be measured with high precision.

The advantages of continuous-wave equipment arise from the relatively simple electrical design of the transmitters, which can be packaged in compact, light-weight units. As currently visualized, a continuous-wave device sets up a pattern of standing waves or interference fringes between

transmitters, or repeaters, at the ends of the arc to be measured. The length of the arc is found by counting, with a suitable device, the number of fringes occurring over this arc. As an accuracy of one-half wave length is obtainable, waves only a few feet long should be used.

Several potential disadvantages of a continuous-wave system must be noted. A count of the number of fringes can be obtained only by moving a counting device from one transmitter to the other, and during this process both signals must be received continuously. Over rugged terrain this may prove impossible. Furthermore, energy reflected from large objects may distort or confuse the interference pattern so badly that the fringes cannot be identified or counted. However, experimentation will extablish the limitations of this type of device.

RADIO WAVE TIMED

With pulsed equipment the distance between two points is determined by the time required for a very short radio signal, or pulse, to traverse the arc. Generally twice this interval is measured, with an increase in accuracy, by determining the time required for a signal to go from one end of the arc to the other, and back over the same path. At the distant end of the arc the original signal may be reflected, as in radar, or it may trigger a second transmitter, as in shoran and loran. For the typical radar set to be of value in surveying, a precise point of reflection, like an echo-box, will be desirable at the distant station.

Shoran utilizes very short waves. Therefore the useful ranges are restricted to the line of sight. By using a high-flying aircraft as an intermediate station at the middle of the arc, individual arcs up to 400 or 500 miles can be measured within a few feet. The effort and expense involved are considerable, but in many instances will be considerably less than those required for ground parties using theodolites to build up triangulation nets across these arcs.

The entire field of electronic surveying lies before us. I am confident that within a few years isolated places like the Hawaiian Islands, which lie more than 2,000 miles from North America, will be tied through electronic measurements to the North American Datum. The oceans will be bridged and the world put on a single triangulation system. The accomplishment of such results will require many improvements in the design and operation of the equipment, a close tie with studies of radio propagation, a complete reassessment of the computational techniques used in triangulation work, and an aggressive, intelligent program. It presents a great challenge.

Part III. Position Determination by Shoran in Hydrographic Surveying

By H. W. Hemple, M. ASCE

Lieutenant Commander; Chief, Division of Geodesy, U. S. Coast and Geodetic Survey

In order to obtain a proper perspective, it is well to review the present method of position determination in hydrographic surveying. When the sounding vessel is within the range of visibility of objects on shore, sextant fixes from the ship to shore stations whose positions are known will give the ship's location. When the ship is beyond this range, other methods are used.

During World War I, acoustic methods were developed for the location of enemy submarines based on the reflection of sound waves in sea water. In the years subsequent to World War I, the Coast and Geodetic Surevy developed these acoustic methods, evolving the radio acoustic ranging method for determining a ship's position. By this method a bomb is exploded astern of the hydrographic vessel on a sounding line and the time of the explosion is recorded on the ship's chronograph; the sound wave travels through the water to the station ship or a sono radio buoy located at a known position, where it is picked up by a hydrophone, translated into a radio wave, and transmitted back to the sounding ship, where it is again recorded on the chronograph. Since the time and velocity of sound in sea water are known, the distance between the known station and the sounding ship can be determined. If the distance to a second station ship can be determined in a like manner, then the location of the sounding vessel is known.

One of the developments of World War II was a comparable method based on the reflection of a radio wave from known station points. If the interval from the time of the initiation of the radio impulse at the sounding ship to the time of receipt of the returned or retransmitted radio wave from the known station is determined, and if the velocity of the radio propagation wave is accurately known, then the distance between the known station and the sounding vessel can be determined.

The U.S. Coast and Geodetic Survey early in 1942 became interested in electronic methods of position determination and has followed developments since then in so far as possible. One of the developments with which we have experimented in this field is the shoran method for determining distances. The use of this equipment for hydrographic survey control has been tested with excellent results. Its application to actual ground surveys has not yet been thoroughly investigated.

The shoran method, as used in hydrographic surveying, consists of a radio impulse which is transmitted from the sounding ship and received at a shore station at a known location and transmitted back to the ship (Fig. 1). The time elapsed from the initiation of the impulse to the receipt of the transmitted radio wave on the sounding ship, when converted into linear units, gives twice the distance from the ship to the ground station. If two ground stations are used, the intersection of their distance arcs will give the location of the ship.

Our experiments indicate that the potential accuracy of this system is such that any distance can be measured with a probable error of less than 5 meters (m) regardless of the length of the line. During the past

Fig. 1. Shoran Determination of Ship's Position in Hydrographic Surveying

season distances were measured with a probable error of 15 m. Two or three ground stations will adequately control a large area. The range of the system is such as to permit accurate surveys in areas as far offshore as 40 to 50 miles, with a minimum of effective use of 1 mile from the shore stations. A shoran fix can be obtained and plotted within 15 sec, and determinations of position can be taken at intervals as small as 30 sec without difficulty. The availability of the shoran fix at any instant permits the close control of the development of any critical errors as far offshore as the range of the equipment and with an accuracy greater than any method now used.

The usefulness of this equipment is not at all impaired by weather conditions. It will operate as efficiently in rain or fog or darkness as it will in fine weather. The effects of static are negligible.

Development of the shoran method for hydrographic surveying indicates that radio acoustic ranging fixes will be outmoded. The ease and rapidity with which the shoran determination can be made and its invariability under all conditions are such that it will supplant other position-determining procedures.

It is now possible to visualize the extension of triangulation to island points several hundred miles distant from a known triangulation system by using the shoran method to measure the long distances involved. An arc of triangulation can be built up based on the measured sides of the triangles and adjusted by least-square procedures. There are, however, certain limitations that must be considered in evaluating the present possibilities of this method.

Recent tests have shown that it is possible to determine the length of lines 100 to 400 miles with an accuracy of 1 part in 15,000, but the angles in this figure, which of course are derived from the measured lengths, will contain errors considerably larger than those to be found in conventional triangulation, indicating that independent azimuth control is necessary to produce an accurate survey. In a single quadrilateral where the distances are determined by shoran methods, only one condition equation results in the adjustment, as compared with four conditions obtained when all the angles are observed.

From this it is evident that a quadrilateral formed by measured sides alone is inherently much weaker than one formed by measurement of all the horizontal angles. Probably a precision of the order of 1 part in 50,000 for the measured sides would be necessary to produce a triangulation network of second-order accuracy, as judged by conventional standards.

RESEARCH NEEDED

Further research and investigation are needed for a possible application of radar methods to the measurement of relatively short distances with precision, employing portable field equipment. This would have its use in traverse operations and would be supplemented by the measurement of angles with the usual surveying equipment. This method would permit traverse work to be carried out over rough terrain where taping would be impossible.

The accuracy of any distance determined by radio methods is directly related to the velocity of propagation used in calibrating the timing unit. The basic physical value in use at the present time is the velocity of light in a vacuum, and this value is then reduced to the condition under which the measurements are made. The probable error of the most recent determinations of the velocity of light is believed to be about 1 part in 50,000. Recent developments in microwave technique will probably make possible the accurate measurements of radio propagation velocity directly by phase-comparison methods over a base of considerable length. Further research is desirable to determine this velocity more accurately.

Part IV. Mechanics of Operating Shoran

By LOREN F. JONES

MANAGER, RESEARCH AND DEVELOPMENT PROJECTS, RADIO CORPORATION OF AMERICA

SOME consider that radar constitutes the most radical advance in surveying in several hundred years. I hope that this is true. At present the location of islands offshore by astronomical measurements can contain errors ranging from a few hundred feet to even a mile. Certainly with radar, locations can be fixed within a very few feet—100 ft, 50 ft, or less.

Ordinarily, the shoran system employs an aircraft, and it has in the work carried on by the Army Air Force, which is described by Colonel Aslakson (see page 297). With an aircraft, one end of the radar circuit is elevated quite high. The range, of course, goes up correspondingly for these "line-of-sight" radar frequencies, and that is why ranges of 300 miles or so are obtained when an aircraft is used. From the air, points on the ground can be easily located by the shoran system.

In this system radar pulses are transmitted from the aircraft. They are picked up by ground stations installed at points to be located. These stations instantaneously retransmit back to the aircraft the original pulses, and the elapsed time for the round trip to and from each ground station determines the distance to that station. The distance between two ground points is determined by flying the aircraft on a course perpendicular to, and approximately bisecting, the line which joins the two points.

There are two dials on the shoran equipment. One indicates the distance in miles to Station A, and the other indicates the distance in miles to Station B. These dials can be read to about 50 ft or closer. In fact the newer equipment will permit much finer readings. A motion-picture camera photographing these dial readings, as the aircraft crosses the line between the two points, records a series of pictures from which data showing the number of miles from each station to the aircraft can be taken.

Of course the minimum mileage is indicated when the aircraft is exactly on the line between the stations; beyond that point the mileage starts to increase again. By plotting the sums of the two mileages against time, a curve is obtained that goes to a minimum and then back up. At the minimum point, the reading of the two dials is the distance (with certain corrections) between the two ground points.

Corrections are made for the aircraft's height and for the radar wave-propagation velocity through the atmosphere at this particular time. A very exact correction for propagation velocity can be made; but as that correction is only 1 part in 50,000 or so, it is not something that has to be done very accurately, at least in the present stage of the art.

EQUIPMENT COMPACT

The shoran equipment itself is quite compact. The ground-station equipment is made so as to be portable by aircraft, so that units can be flown in to inaccessible islands or other points,

and they are reasonably light in weight. The total weight of the ground equipment is some 1,000 lb for a ground station, and it is broken down into units that can be carried by two men. It can be set up in a matter of several hours.

The ground equipment practically operates itself. The operator starts the gas-engine power unit and adjusts the equipment, but no readings are taken at these stationary points. The ground stations send back to the airplane the signals which they receive. All the data are collected in the aircraft.

The equipment in the airplane is quite small, weighing about 230 lb. In practice it is not hard to teach a man to operate it.

Part V. Shoran Surveys by Army Demonstrate Accuracy

By C. I. Aslakson, M. ASCE

Lieutenant Colonel, U.S. Army Air Corps, 311th Reconnaissance Wing

THE importance of geodetic surveys by shoran is apparent in these days of guided missiles. There are islands very near the coasts of the United States that have been located only by astronomic means. Unquestionably some of these islands are at least a mile out of their plotted position. The probability that they can be located very accurately—to within a few feet—has been proved by tests run by the Army Air Forces.

A shoran mapping project was run at Denver, Colo., under the auspices of the Air Forces Board, the experimental organization of tactical measures. Reason for the tests was to develop tactics for the use of shoran instruments in geodetic surveying. These instruments had originally been developed for locating targets in blind bombing.

The problem was delegated to the 311th Photo Wing, 7th Geodetic Control Squadron, because this unit had the personnel available for making the necessary mathematical investigations in connection with the project, the necessary airplanes, the personnel to some extent familiar with surveying, and also a few geodesists.

Stations were established at Cheyenne, Wyo.; Imperial, Nebr.; Garden City, Kans.; La Junta Air Field, Colo.; and Pike's Peak. There was a particular reason for selecting the Pike's Peak station. It was chosen so as to give a very rigorous case, the line being about 99 miles in length, and having a considerable difference in elevation. The station on Pike's Peak was over 14,000 ft high and the one at La Junta was 4,300 ft high. That is quite a test.

To measure the distance between the two stations, an airplane carrying the shoran equipment and observers was flown on a course crossing the line between the two points. The course was sometimes normal to the line and sometimes an arc about one of the stations. While on course the dials of the equipment were continuously recorded on 35-mm film. From these records distances and times were plotted. A curve was then fitted to the points plotted and the minimum distance computed.

This computation, which requires about an hour and a half, gives only the minimum recorded distance between the two points. After this has been done, another computation applies corrections to give the true geodetic distance.

ACCURACY OBTAINED

An indication of the accuracy obtainable with present shoran equipment was given by these tests, results of which appear in Table I. The 99-mile line between Pike's Peak and La Junta airfield was measured with an error of plus 0.016 mile. Error as used here is the shoran distance minus the geodetic distance. This is our worst proportional error, 1 in 6,100.

The altitude of the plane enters into the geodetic computation. Consequently we had to make quite an investigation of the altimetry in shoran, and to inquire into the types of errors and the order of the errors caused by errors in elevation. For distances of from 75 miles up, we found that an error of the order of 50 to 100 ft could be tolerated without serious uncertainty from a geodetic standpoint.

There are several ways of getting the altitude within 50 ft in practice. A great deal of this work is going to be done over water areas, and a radio altimeter can be used in connection with the barometric altimeter for obtaining an altimeter setting. Actually this could not be done out there, so we used all available radio weather ground data in the entire area. We drew two weather maps every day and determined our altitude corrections to the barometric altimeter from these data.

Then it was necessary to make an investigation of the correction for the velocity of radar wave propagation. In this connection the conclusion was reached that atmospheres can be classified into about five types. A set of tables has been drawn up for each type, which can be used under most conditions to make the velocity correction. The type of atmosphere is selected by a meteorologist who goes along on the flight.

Table I. Results of Shoran Measurements of Known Distances

Points Between Which Distance Was Measured	Known Distance in Miles	No. of Observations	Error by Shoran: Miles	Error by Shoran: One in
Pike's Peak–La Junta	99	..	+0.016	6,100
Garden City–La Junta	149	13	−0.008	19,000
Pike's Peak–Cheyenne	162	10	+0.015	11,000
Imperial–Cheyenne	174	28	+0.021	8,200
Imperial–Garden City	181	12	+0.008	22,000
Imperial–La Junta	199	11	+0.004	50,000
Imperial–Pike's Peak	216	11	+0.019	12,000
Cheyenne–La Junta	227	23	+0.004	50,000
Pike's Peak–Garden City	237	18	+0.021	11,000
Cheyenne–Garden City	308	19	+0.002	81,000

When the shoran instrument was designed, the designers were asked to produce an instrument only of sufficient accuracy to position a plane in the air within about 50 ft, and that from a single pair of observations. It was definitely the most successful blind-bombing instrument that was developed, and that is why it was selected for these tests. Now the Army is going to request the design of an instrument particularly for geodetic work.

Part VI. Loran, New Long-Range Aid to Navigation

By Fletcher G. Watson

LORAN is a coined term taken from a proved application of special electronic equipment, the long-range radio aid to navigation. It is a valuable aid in marine surveying and fathometry.

While loran is not capable of the same precision as radar and shoran, there are a number of very long arcs which it can be used to bridge with reasonable precision. Unlike radar devices, loran operates on a relatively

long wave length—the longer the better. The current extensive navigational grid uses the 1,800 to 2,000 kilocycle (kc) band. Direct signals, or "ground waves," can be received over sea water with a usable strength up to ranges of 500 to 800 nautical miles. The useful range is limited by the power of the transmitter, at present about 90 kw peak power, and by the static level—which varies considerably between daylight and darkness, with the season, and with geographical location. Under optimum conditions, similar to those that would be chosen for survey work, usable ground-wave signals have been received at ranges of a thousand miles.

A loran pair consists of transmitters located at the two ends of the base line. One transmitter, termed the "master," transmits a number of pulses each second. For each master pulse received, the other station, called the "slave," transmits a corresponding pulse. At the master station the double time interval is read. Certain carefully controlled time delays are introduced at the slave station for convenience in operation, but these are readily removed from the reading at the master station. With existing equipment, the inherent systematic errors of operation and reading are about one microsecond. As the signal travels over the double path at a rate of 983 ft per microsecond, the length of the base line is determined within about 500 ft.

MOBILE EQUIPMENT

For special loran installations the transmitting equipment was compressed into relatively small packages. The Coast Guard used truck-mounted sets and collapsible metal towers for mobile stations, while the Radiation Laboratory and the Army Air Corps developed compact transmitters with a peak power of about 25 kw as air-transportable units. These compact transmitters could readily be applied to the measurement of arcs 200 to 300 miles long over water. Ties between Florida, the Bahamas, and Cuba could be made with ease.

Although most of the base lines used for the existing navigational system are less than 400 miles long, three long base lines are in routine operation. The one from Battle Harbor, Labrador, to Frederiksdal, Greenland, some 590 miles long, has operated constantly since 1943. In the Pacific area military necessity required the installation of two base lines longer than usual. Iwo Jima is tied to Okinawa over 730 miles away, and Iwo is also tied to O Shima in Sagumi Bay near Tokyo 600 miles away.

With existing loran equipment, Bermuda could be referred to the North American Datum through strong signals received from stations at Nantucket and Cape Hatteras (Fig. 1). Under favorable conditions additional ties could be made to Charleston, S.C., and Hobe Sound, Fla.

Inasmuch as the existing loran system was designed and installed during hostilities to provide a naviga-

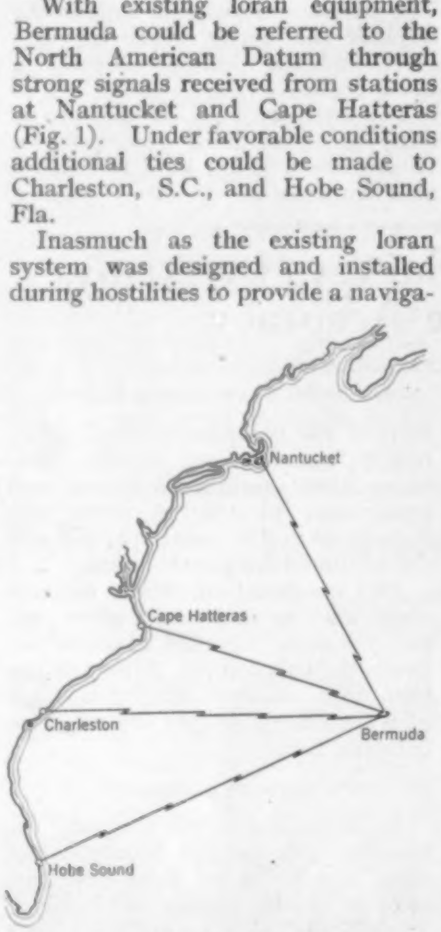


FIG. 1. LORAN LINKAGE BY WHICH BERMUDA COULD BE REFERRED TO NORTH AMERICAN DATUM

tional pattern for military air and sea craft, the stations are not well located for triangulation, and it has not been feasible to link them in various combinations to provide a triangulation net. Even so, some information on gravitational deflections of the vertical on isolated atolls has been obtained.

GRAVITATIONAL DEFLECTIONS OBSERVED

High-quality astronomical positions were used for the coordinates of the transmitters on the isolated islands; thus discrepancies between the observed and computed master-station readings indicated the effects of gravitational deflections of the vertical. As an example, consider the link between Guam and Ulithi. The station at Guam is located at Cocos Island, a sand spit just off the southern end of Guam. About 100 miles away to the southeast is Nero Deep, while another deep of 5,000 fathoms lies north of Ulithi. It was assumed that at Guam the gravitational deflection was probably 20 in. toward the south, while that at the station on the northern side of Ulithi was probably 15 in. northward.

The astronomical positions of the stations were adjusted for these deflections and the navigational grid computed while the stations were still under construction. The observed base-line length exceeds that computed from the corrected positions by some 3 microseconds, but without the estimated corrections the difference would have been 9 microseconds, which would have introduced serious navigational errors. It seems that the deflection at Cocos Island, Guam, is about 30 in. to the southward and that at Ulithi is about 20 in. northward.

The existing loran patterns of fixed lines of position for navigation should prove valuable in marine surveying and fathometry along both the Atlantic and the Pacific coasts of the United States and in other areas near transmitting stations. Near the base line of a loran pair, 1 microsecond—which is the limit of accuracy of the present system—is equivalent to a displacement of only 500 ft. Approximately this same accuracy can be obtained out to the 100-fathom line even along the Grand Banks. In the region between 50 and 200 miles offshore, where the precise location of a surveying vessel cannot be determined with present methods, loran will supply a fix that is accurate within a half mile regardless of the weather.

LIMITATIONS

The present form of loran has little to offer for survey work over land. At the 2,000 kc frequency now in use, ground attenuation weakens the signal at such a rate that the useful range is decreased to around 130 miles at the surface. The low precision of loran compared to shoran or radar devices renders it unsatisfactory for the measurement of such short paths over land. Some consideration has been given to a low-frequency loran system which would utilize radio waves longer than those used for commercial broadcasting. Such waves would not be rapidly attenuated over land and would therefore have greater ranges than the present signals. It is believed that pulsed equipment can be built for these long waves and that with it base lines of 500 miles or more might be used. If a precision of one microsecond could be obtained, this modification of loran might prove of value for surveying over land.

In all these pulsed systems, we measure the interval required for the signals to traverse some definite path, and from the time deduce the distance traveled. This requires a knowledge of the velocity of propagation with at least the same percentage of accuracy as that attained in the time-interval measurement. Already in shoran, where fractions of microseconds are used and the signals go from high-flying aircraft to and from the ground, variations in the velocity of propagation have introduced additional worries. Careful calibration over known paths appears to have provided velocities of satisfactory accuracy, but variations in the temperature and humidity of the air at various levels must be considered.

For the loran ground-wave signal flowing close to the surface of the sea, the velocity used in the computation has been confirmed against triangulation to about 1 part in 6,000 and is probably correct and stable to 1 part in about 20,000. With long arcs and high timing precision, the velocity of propagation must be carefully studied as it may determine the limit of the attainable accuracy.

Part VII. Accurate Determination of Range with Radar

By John S. Hall

Radiation Laboratory, Massachusetts Institute of Technology

It is evident that the accuracy with which range can be determined today by pulsed radar techniques does not compare favorably with that obtainable by trigonometric surveys using optical methods. However, radar does have the interesting compensatory feature of being useful for direct measurements of range from a single site.

At the Radiation Laboratory of the Massachusetts Institute of Technology, four radar systems were developed that could be used for very accurate range measurements. Accurate calibration runs were made on only one of these systems—SCR-584. These tests were conducted on an especially tailored unit by expert personnel. Probable errors of 10 to 15 ft were obtained at ranges of ten miles or less. The location of the radar overlooked the water, and it was possible to note the ebb and flow of the tide by measuring the position of buoys. There is reason to believe that very nearly this same accuracy could be obtained at ranges of 100 miles or more if there were no uncertainty in the value of the velocity of light.

The Handy Radar Unit Complete Except for Power Source

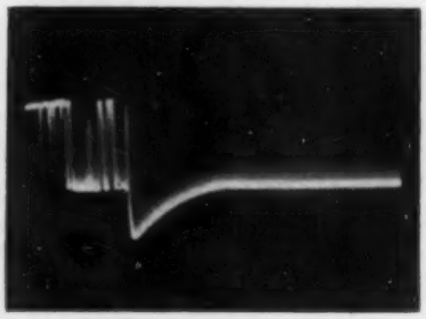
An important problem that arises in connection with accurate radar ranging is concerned with the identity of the target. Radar beams are often a few degrees wide. Since the azimuth resolution is usually not better than half the beam width, there is not much discrimination in azimuth. If the radar instrument were sited in a commanding position overlooking the landscape, and if the distance to a point on a hill, say 20 miles away, were required, at least two methods might be used to indicate the exact point on the hill in question.

A radar beacon could be placed there. This beacon would then receive the radar pulses and, after a delay of one or two microseconds, transmit them back to the radar. These beacon pulses could either be made much greater in intensity than the radar pulses reflected en masse from the hillside, or they could be separately presented. The difficulty here is concerned with the measurement of the delay time of the beacon. Since radio waves travel 984 ft per microsecond, either this delay must be carefully monitored at the beacon or very stable beacons must be built.

Another method might be to place a flat metallic reflector at the desired point. If this plate were carefully oriented by means of a transit in such a way that the radio wave fronts would strike it normally, a characteristically strong signal should result. The problem of measuring the signal delay would then be avoided.

A number of beacons or reflectors having an area of 10 sq ft could be strategically placed at various points in the line of sight with a central radar station. Since radar cannot begin to compete with optical methods in measurements where angular accuracy is required, the bearing and elevation of these reflectors or beacons could be measured with a transit to 1 or 2 sec of arc, and then their ranges to 10 or 15 ft. Since such central stations might be fifty or more miles apart and not in the line of sight with one another, they might be tied together by an improved shoran.

It may be of interest to explain something about the mechanics of a radar system that might be useful for accurate ranging work. One of the four high-accuracy radar systems previously mentioned was called the "HR" or "handy radar." Except for the source of power (110 v, a-c, 1,500 w) the accompanying photograph shows the complete system. The paraboloid is 4 ft in diameter and the equipment weighs 250 lb. Since this radar could consistently pick up airplanes at a distance of 20 miles, its range capabilities are entirely adequate for the type of measurements outlined in the preceding paragraph.



A-Scope of Radar Signals
Operator Makes Break at Left, Then Reads Range with Dial

Another illustration shows an A-scope presentation which can be used when high-range accuracy is desired. The time base or range is parallel to the x-axis, and the signal intensity corresponds to the ordinate. An operator turns a knob and makes the leading edge of the "step," or break in the time base, coincide with a selected signal, and then reads its range on a dial or Veeder counter. Accurate ranging would be done on a 2,000 yd sweep, or one ten times as fast as that shown in this illustration. The duration of the step can be made as short as one-hundredth of a microsecond.

St. Lawrence Power and Navigation Project Awaits Legislation

Advance Plans for Barnhart Island Power House

By C. H. Giroux

Special Assistant to the Chief of Engineers, U.S. Corps of Engineers, Washington, D.C.

Development of hydroelectric power, to the total of 2,200,000-hp capacity, has been recommended by the St. Lawrence (River) Advisory Committee. Site of the main power units is at the foot of Barnhart Island in the International Rapids section of the river. This project is awaiting approval by Congress of legislation now pending.

The project as recommended consists of the following principal features:

1. Iroquois Dam at Iroquois Point, to regulate the flow from Lake Ontario for the purposes of maintaining the lake level, and of aiding in the formation of an ice cover in the winter season.
2. Point Rockway Canal and Navigation Lock to bypass the Iroquois Dam.
3. Long Sault Canal and two navigation locks, bypassing the Long Sault Rapids.
4. Long Sault Dam at the head of Barnhart Island on the south channel of the St. Lawrence River to create the power pool and to serve as a flood and emergency spillway for the pool.
5. Barnhart Island Dam and Power House at the foot of the island, across the north channel of the river.

REGULATED FLOW AVAILABLE

From the standpoint of hydroelectric power, the Long Sault Rapids section of the St. Lawrence offers great possibilities because of the large regulated flow and the potential head that is available for development. Figure 1 gives a comparison of the flow of this river with that of the lower Columbia, which illustrates the effect of the tremendous storage capacity of the Great Lakes in smoothing out the flow and thus enhancing the value of the water for power-generating purposes.

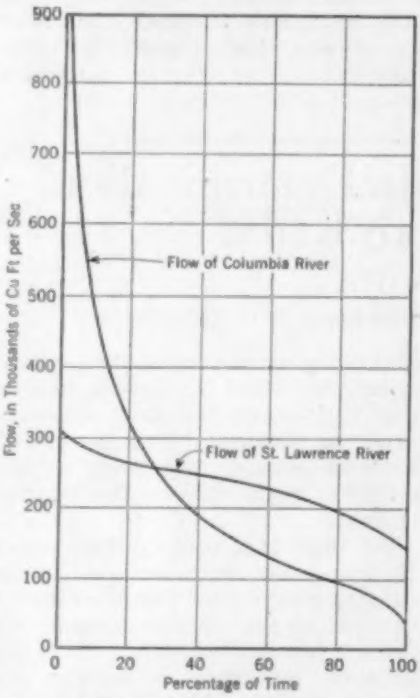


Fig. 1. Comparison Between Flows of St. Lawrence and Columbia Rivers

In order to obtain the full advantage of the potential head between Lake Ontario and the foot of the rapids, a single-stage project is proposed, with the power house at the foot of Barnhart Island (see Fig. 2) to develop a head which may vary from an extreme minimum of 71 ft to an extreme maximum of 87 ft. The normal head used for the design of the hydraulic equipment is 81 ft. Based on flow records extending over a period of about eighty years, it is computed that with this head and with the installation recommended, a firm capacity of 1,150,000 kw, a firm annual energy of 10,110,000,000 kwhr, and an average annual energy of 12,600,000,000 kwhr can be obtained at the site selected. Exhaustive studies of water utilization, cost, efficiency, space available, manufacturing facilities in the United States and Canada, and other considerations led to the conclusion that 36 generating units, each having a normal rating of 61,100 hp, will provide a well-balanced plant which will be practical and economical and make full use of the available resources.

BOUNDARY BISECTS POWER HOUSE

The power-house structure is 3,585 ft long and 180 ft wide, bisected transversely by the international boundary line. Starting at the center, each half includes one ice sluice at midstream, the power house proper with one house service unit and 18 main units, and two more ice sluices at the shore end. The forebay level and downstream regulation are maintained by the operation of the spillway on Long Sault Dam, a separate structure at the head of Barnhart Island and on the south channel of the river.

The main turbines are of the Francis type, designed to deliver 61,100 hp each at best gate and a normal head of 81 ft; also 67,100 hp at full gate and the same head. The water capacity will be 7,200 cu ft per sec each at best gate, or a total of 259,000 cu ft per sec for the complete plant. Speeds of 69.2 rpm for the 60-cycle machines, and 68.2 rpm for the 25-cycle machines were selected as giving specific speeds which would avoid objectionable cavitation and permit an economical generator design. The Francis type of runner was chosen in preference to the propeller type on account of the higher permissible setting with less excavation, which more than offsets the lower cost of higher-speed generators which could be used with the propeller-type turbines.

Fig. 2. Site of the Barnhart Island Power Development

The main generators on the United States side and six on the Canadian side will be rated at 55,000 kva at 95% power factor, and will generate at 13.8 kv, 60 cycles. Because a large part of the load of the Hydroelectric Power Commission of Ontario is 25 cycles, 12 of the Canadian machines will be constructed for that frequency and rated at 58,000 kva, 90% power factor. Generators are totally enclosed, with integral air coolers, but arranged so as to utilize the waste heat from them to augment the power-house heating system during the winter season.

Two units of 7,500 kva, 60 cycles, 13.8 v, 80% power factor, 150 rpm, will be used to supply normal service for station auxiliaries, heating, and lighting.

TRANSFORMERS IN POWER HOUSE

The means for conveying power from the generators to the transmission and distribution systems which must necessarily be utilized to market a block of power of this magnitude, constituted the major electrical problem, particularly in view of the unknown conditions that might prevail by the time the plant was ready for service. It was quite apparent from the first that it would not be economical to carry the power away from the power house at generator voltage to a transformer and switchyard on the mainland; consequently provision was made for locating the transformers in the power house and for transmitting power to high-tension switchyards by means of high-voltage cables and/or overhead lines.

The St. Lawrence Advisory Committee, consisting of representatives of the Federal Power Commission, the Corps of Engineers, and the New York State Power Authority, was established by executive order of the President in October 1940. In compliance with this order, the Chief of Engineers established the St. Lawrence River District at Massena, N.Y., which, under the direction of Col. A. B. Jones, and working in conjunction with the U.S. Advisory Commission, the corresponding Canadian Committee and other consultants, developed this project for improvement of the International Rapids section of the St. Lawrence River. This plan, in addition to the hydroelectric features, contemplates a navigation channel having a minimum depth of 27 ft, and locks 800 ft long, 80 ft wide, and 30 ft deep over the sills. Studies, estimates, and preliminary designs for the Barnhart Island Power House were made by the Harza Engineering Company of Chicago under the general direction of the District Engineer.

Editor's note: Information contained in this article was presented by Mr. Giroux in an address before the Midwest Power Conference in Chicago.

Less Sand and Water in Air-Entraining Batches Improves Concrete

By MYRON A. SWAYZE

DIRECTOR OF RESEARCH, LONE STAR CEMENT CORPORATION, NEW YORK, N.Y.

MORE workable, more durable concrete can be obtained with mixes containing less water and less sand—and an air-entraining cement, or by adding an air-entraining agent at the mixer. Air-entraining cements and several types of air-entraining agents have been in use long enough to permit definite conclusions as to the behavior of concrete under a variety of conditions. This concrete, with its tiny air cells, is more resistant to frost action and salt action and less permeable to water.

To better observe the action of air-entraining cement in structural concrete, the Lone Star Cement Corporation used this product for the construction of a 300,000-bbl silo warehouse and new packhouse at Hudson, N.Y., in 1940. The warehouse consists of 27 silos, 30 ft in diameter and 100 ft in height, built with sliding forms. The packhouse is a two-story building with basement. The air-entraining cement used was Type 1, with sufficient vinsol resin interground to produce 2.5–3% air voids in the concrete mix.

The higher workability and ease of placement were highly satisfactory to the contractor. The only special precaution required in placement was extra vibration and spading where the concrete had to be placed under horizontal forms of considerable length. This was due to the cohesiveness of the mix, which caused the concrete to flow en masse.

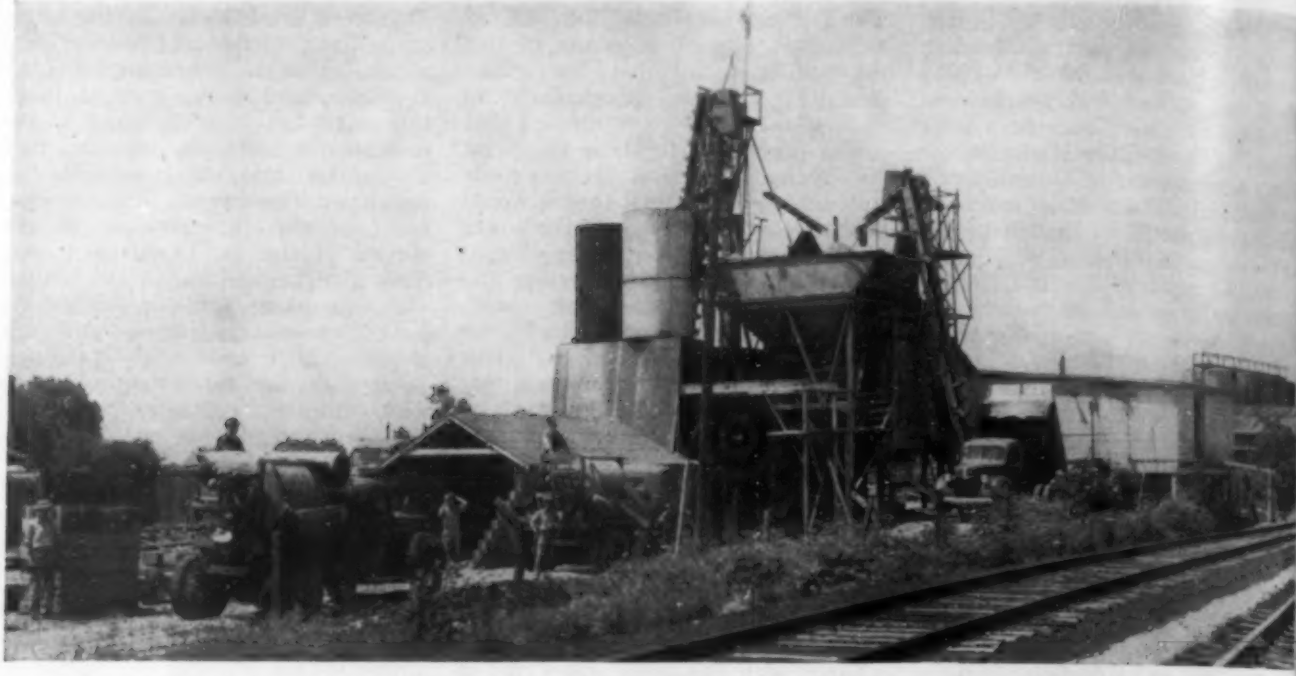
Other structures built by Lone Star include a raw-material storage (1940) and cement warehouse (1941) at Houston, Tex. Since no freezing and thawing were involved in this area, less air-entraining agent was employed in the cement. No significant decrease in concrete strength was found, although a marked improvement in the workability of the concrete resulted.

MUCH LESS PERMEABLE

An unforeseen advantage for concrete containing entrained air was found in the Hudson silo construction. Previous experience with the storage of cement in new concrete silos has been that a layer of hardened cement a half inch or so thick gradually builds up on the inside of silo walls that are exposed to the weather on their exterior face. With predrying of the interior before use, no such layer has been found with the air-entraining cement concrete during the past five years of use. The conclusion from this observation is that concrete with entrained air is materially less permeable than similar normal concrete, and that once it is dry, no water can penetrate to the interior. The same observation has been made at Houston, where the air entrainment was less in amount. No frost action has been found at any point on the Hudson structures.

Air entrainment in concrete is caused by a number of classes of materials, either present in the cement or added at the concrete mixer. Pine resins, animal or vegetable fats and oils, and certain special compounds produced for the purpose all act to incorporate minute air cells in the cement mortar during mixing. Blends of normal portland and natural cements frequently exhibit air-entraining properties owing to the presence of air-entraining agents in the natural cement, originally added as an aid to the grinding operation.

The size of the entrained air cells is in the range of the coarser cement particles and the finer sand grains. Since the air cells are elastic and nonabsorbent, their first action in freshly mixed concrete is to render the mix more plastic and workable and to



PRODUCERS OF READY-MIXED CONCRETE FIND ADVANTAGES IN ADDITION OF AIR-ENTRAINING AGENT AT MIXER
The Marion (Ind.) Ready Mixed Concrete Company

decrease the amount of mixing water required for a given workability. When concrete containing entrained air is placed and finished, a notable feature is the greater cohesion of the paste, resulting in decreased segregation of the solid components of the mix. Separation of water at the top surface is materially reduced. Finally, the hardened concrete has much improved resistance to the action of frost, and to the action of salts commonly applied for removing ice from the surface. The concrete is also less permeable to water.

The amount of air which a given air-entraining cement or quantity of air-entraining agent will incorporate in concrete is dependent on the consistency of the mix, the type and size of aggregates, as well as on the cement content of the concrete and the type of cement used. In general, the quantity of air increases as the amount of water added to the batch is increased, or as the cement content of the mix is decreased. Exceptions may be noted at both ends of the scale, however.

FOR SAND-CEMENT BLOCKS

In very lean cement-sand batches, mixed to a dry consistency for the manufacture of sand-cement block, essentially no increase in air entrainment—or even a slight decrease below amounts obtained with normal cement—will be found. Here the plasticizing action of the addition dominates its tendency to entrain air, and greater compaction in tamping or vibrating the units is achieved, resulting in slightly increased weight of units.

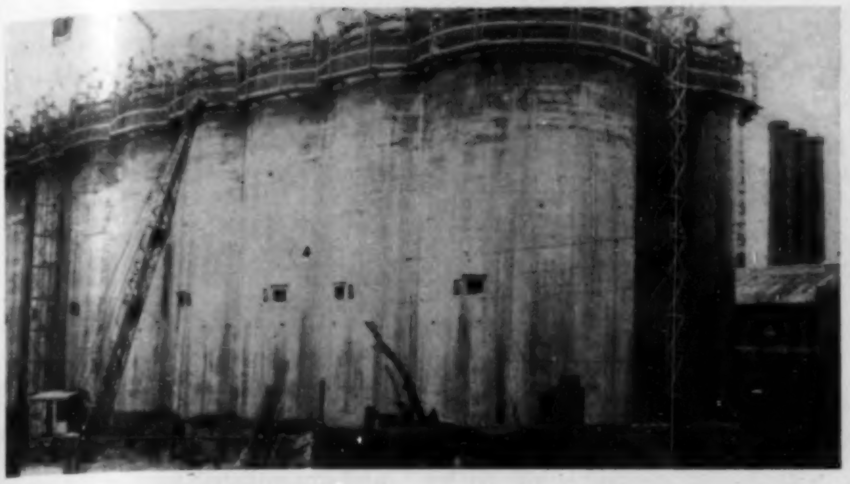
Where excessive quantities of water are used with regular concrete mixes, producing slumps in the range of 10 in. or over, the paste may be so thin that it is unable to retain the air cells formed, and will therefore yield a lower percentage of air than expected. However, with any modern means of concrete placement, there is no excuse for producing concrete of this consistency.

The present standard specifications for air-entraining cement are primarily designed to yield 3% to 5% air in mixes suitable for use in concrete pavements. In leaner or wetter batches than are used in such work, the air content of the concrete will necessarily be higher. It is natural to expect that concrete strengths will be reduced as air contents become excessive, since air cells have no strength in themselves. It is therefore essential that compensation be made for this potential decrease in strength in the mix design. With such compensation, a notable improvement in the properties of the concrete will be found, with practically no decreases in compressive or flexural strength. Experience indicates that air-entraining concrete can be proportioned to produce the desired design strengths with the same degree of assurance as plain concrete.

When either normal cement is replaced by air-entraining cement, or air-entraining agents are added at the mixer, the proportions of sand to coarse aggregate should be revised to compensate for the volume of air entrained. Since the size of the air cells is of the same order as the sand grains, the best means of revision is simply to remove an amount of sand equivalent in volume to that of the air entrained. This revised mix will still have better workability compared to the regular mix with normal cement, and will require less mixing water, owing to replacement of sand by air cells. This reduction in water required by the change from normal portland mixes to the revised air-entraining batches amounts to $^3/_4$ to $1^1/_4$ gal per sack of cement in the usual range of cement contents. In very lean mixtures, it may amount to as much as 2 gal, with marked improvement both in workability and strength.

In the laying of concrete pavements, floor slabs and such, there is decidedly less tendency for separation of mortar and coarse aggregate in the screeding operation. Gravel or stone pockets, with resulting honeycombing and zones of weakness at the sides and ends of slabs, are thereby largely eliminated. The relative freedom from bleeding of air-entraining concrete preserves the uniformity of the material as laid by retarding or stopping the normal upward flow of mixing water after the concrete is in place.

This relative freedom from water gain for concrete with entrained air becomes of special value in rein-



CONCRETE SILOS AT HUDSON PLANT OF THE LONE STAR CEMENT CORPORATION ARE IMPERMEABLE

forced concrete walls, columns, and beams, where segregation of water toward the top allows a corresponding subsidence of the solid portion of the mix away from the under side of restrained reinforcing steel. While few data on the bond of air-entrained concrete have been published, such information as is available indicates that there is little or no change from the bond-compressive strength relation found for normal cement concrete. However, the decrease in the tendency to bleed with air entrainment should materially improve bond to restrained steel in the upper sections of concrete members.

ADDING THE AGENT

The choice as to whether to use cement containing an interground air-entraining agent, or to add the agent to normal cement at the mixer, should be given careful consideration by the engineer or concrete producer. Both methods of getting entrained air in concrete have some advantages.

Where the air-entraining agent is interground with the cement, the present cement specifications and methods of test provide for direct measurement of the amount of air that the cement will entrain in a standard mortar. While the amount of air entrained is primarily designed to be most suitable for types of concrete used in pavement construction, the quantity found in wetter or leaner mixes should not be inordinate. In general, where the addition is regulated to produce slightly over 3% in concrete of the highway type, a maximum of about 8% should be about the limit expected for lean, wet mixes. By proper redesign of batch proportions, this maximum can be decreased.

Intergrinding of the air-entraining agent at the mill has the advantage of adequate laboratory regulation of the quantity added, and of control devices frequently lacking in field operations. The agent is furthermore uniformly distributed throughout.

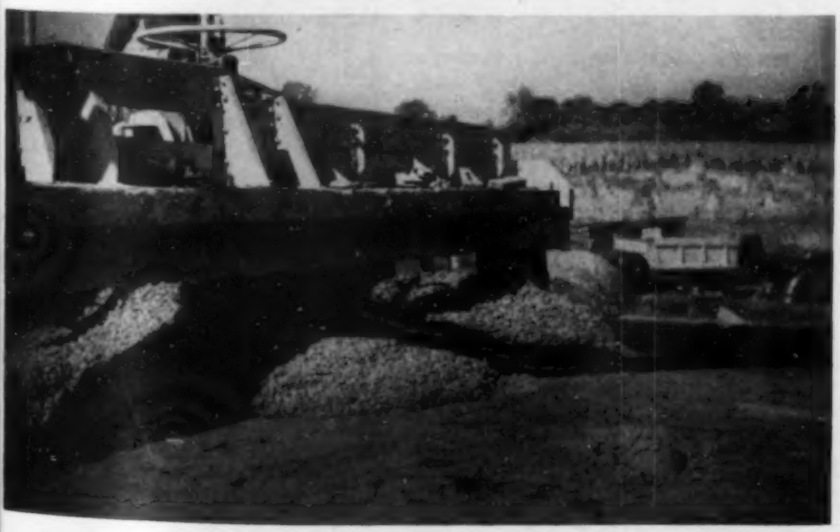
The quantity of air-entraining agent required to yield a certain amount of air in concrete necessarily varies from one brand of normal cement to another, being influenced by other physical and chemical characteristics of the products. Manufacturers compensate for these differences in the amount of air-entraining agent added, so that the outcome should be greater uniformity in the action of different brands of air-entraining cement than where a uniform addition of agent is made to different normal cements at the mixer.

On the other hand, cement producers cannot be expected to provide cement with more than a single quantity of added reagent, or cement storage problems, already increased by the necessity of providing for both normal and air-entraining cements, would become extremely difficult.

CHOICE BETWEEN TWO METHODS

Concrete producers who are primarily interested in improved workability and decreased bleeding tendency, and not in high resistance to frost action, can obtain these results with considerably less air-entraining agent than is needed for security against damage from freezing and thawing. Under these conditions, and where the concrete producer has adequate facilities for constant control of all the ingredients of the mix, including the addition of reagent, it is preferable to add the air-entraining agent at the mixer, especially if the cement used is confined to a single brand. Where high durability against frost action is needed, and where more than one brand of cement is used, more uniform results can generally be secured by employing air-entraining cement.

For producers of ready-mixed concrete who have a wide range of cement contents, aggregate sizes, and concrete consistencies to deal with, the choice between the two methods of securing entrained air depends very largely on local conditions. While concrete containing entrained air is applicable to practically all types of work, requirements for normal cement concrete on the part of some purchasers would double cement storage needs, unless the air-entraining agent is added at the mixer. To handle these additions, however, very close attention must be given to changes from one type of mix to another or the air content will vary more widely than where air-entraining cements are used.



WORKABILITY OF PAVING CONCRETE CONTAINING AIR-ENTRAINING AGENT EVIDENT ON NEW HAVEN, IND., PROJECT

Disposal Plant to Alleviate Boston Harbor Nuisance

II. Problem of Solids Disposal Solved

By Karl R. Kennison, M. ASCE

Chief Engineer, Metropolitan District Water Supply Commission, Boston, Mass.

Tidal flow in Boston Harobr provides a convenient agent to dispose of solids from the new Nut Island sewage works. The plant, soon to be constructed, will provide facilities for flexible operation, a first step to clear up the health menace in the harbor. This is the second part of a paper presented by Mr. Kennison before the New York session of the Sanitary Engineering Division.

First of a series of sewerage projects in the metropolitan district of Boston is the construction of the Nut Island sewage treatment plant. A project of the Metropolitan District Water Supply Commission, the works will pick up and treat a maximum of 300 million gallons of sewage a day, which was formerly dumped raw into the harbor. Among the unusual features of the plant, those providing for disposal of solids are noteworthy.

After passing through racks, grit channels, comminutors, low-lift pumps, and aeration tanks (as described in Part I, June Civil Engineering), the sewage flows to the sedimentation tanks. Sewage approaches these tanks in a single straight conduit, so designed that at all points the conduit wall itself is structurally the west end of the tanks. There are two take-offs from the conduit to each of the six tanks, and the conduit is progressively reduced in size at each of these take-offs so as to maintain a velocity at the design rate of flow—112 mgd—of about 2 ft per sec in all main portions of the conduit. The velocity will be generally not less than 1 ft per sec when the plant is discharging at as low a rate as 60 mgd, about 1.25 ft per sec at 70 mgd, and about 1.7 ft per sec at 95 mgd. At the maximum rate of 300 mgd, the velocity will be 5.4 ft per sec. Incidentally, one advantage of the great length of trunk sewer approaching the plant is that during low rates of flow the storage available in this sewer will make it possible to step up the rate through the plant intermittently for flushing purposes.

The bottom of the conduit, which tends to collect sediment along its entire length, is designed with a slight slope toward the tank side, and the top of the conduit, which tends to trap grease and scum, is correspondingly sloped upward toward the tank side. Each take-off is in the form of a chimney built on the tank side and projecting as required into the tank itself. To get the maximum scouring velocity where most needed, and to provide mixing and balanced proportioning of grease and solids to each tank, each take-off is fed at two points, one at the bottom and the other at the top of the conduit. At the top of each chimney any scum or grease can flow without obstruction into the sedimentation tank, but the main discharge divides and enters the tank through 24-in. outlets, four from each take-off, or eight into each tank. The discharge from these outlets is deflected by cross baffle walls of standard design. An elbow at the top of each chimney is so designed as to allow a lightweight and low-head gate to be closed to isolate any of the six sedimentation tanks.

Uniform Distribution

This feature of the design also provides the opportunity to obtain as uniform a distribution of the sewage flow to the six tanks as may be desired by throttling the discharge to one or more of the tanks. The gates provided for this purpose at the chimney elbows can be initially adjusted as may be found necessary to correct the distribution so as to make it uniform for any total quantity of sewage pumped. They should then provide practically the same uniform distribution for any other rate of flow, since both the friction losses in the conduit and the take-off orifice losses between conduit and tank vary with the discharge in practically the same manner. However, the intention has been to make the take-off openings to the nearer tanks large enough so that the distribution of flow between the six tanks will always be satisfactorily uniform without the necessity of throttling the discharge into the more remote tanks and thus putting an additional head on the remaining low-lift pumps, and small enough so that the distribution will, in all probability, be sufficiently uniform to make it unnecessary to have any throttling of the discharge to the nearer tanks.

In other words, it is anticipated that no throttling whatever will be necessary in the operation of the plant. The variation of flow through a sedimentation tank and over its spillways would have to be as much as 5% in order to change the water level by 0.005 ft. A variation of as much as 10% either more or less in the frictional head losses along the influent conduit, or the same variation in the orifice discharge losses between conduit and tank, should result in a variation in the discharge rate of not more than $1^1/_3$% in any single tank.

There are six covered sedimentation tanks of standard, rectangular, flow-through type. Each is 185 ft long and 64 ft wide, the width being divided into four 16-ft channels by three sets of columns and beams

Table I. Anticipated Solids Removal

	Under Present Conditions		Under Design Conditions, About 1960	
	Normal Dry Summer Weather*	Average	Normal Dry Summer Weather*	At Design Rate of 112 Mgd
Approximate detention period in aeration channels . . .	32 min	24 min	25 min	20 min
Approximate detention period in sedimentation tanks . .	141 min	105 min	110 min	88 min
Anticipated suspended solids removed	65%	58%	60%	50%
Solids removed daily	91,000 lb	81,000 lb	108,000 lb	90,000 lb
Raw sludge removed daily (at 95% moisture)	215,000 gal	191,000 gal	255,000 gal	213,000 gal

*Such as affects recreational use of harbor.

which support the sludge and scum-scraper mechanisms. The average depth to spillway level is about 13 ft. These six sedimentation tanks are expected to remove the amounts of solids given in Table I.

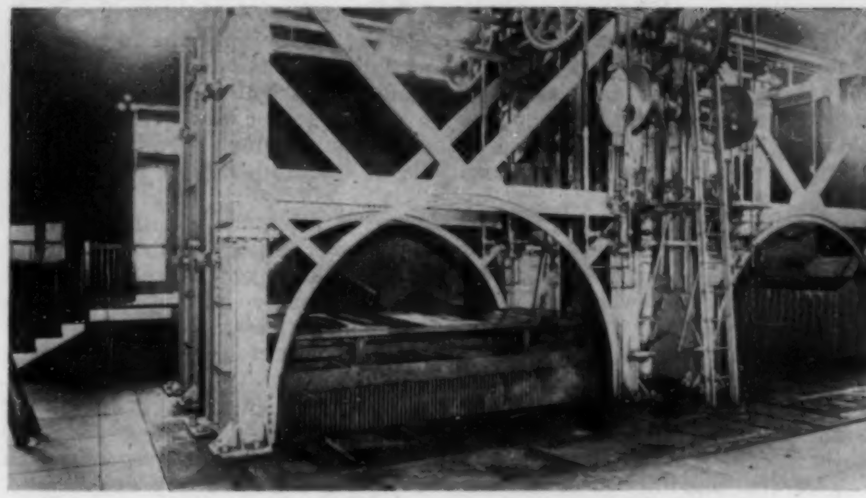
A system of effluent troughs of standard design at the outlet end provides a total spillway length of 288 ft in each of the six tanks. The crests are V-notched and should maintain the sewage level in the tank, under the design rate of flow, at El. 122.55. (Elevation 100 is mean low water in Boston Harbor.)

SLUDGE AND SCUM COLLECTORS

The main sludge and scum collectors in the sedimentation tanks depart but little from standard design. However, the sludge cross-collectors at the entrance end have their return flights elevated above the sewage level for access, and the sludge collected from each of the three pairs of adjacent tanks is collected in two adjoining hoppers at the sludge pumps. Each of these hoppers constitutes an addition to the tank and provides a vertical chimney through which the flights of the collector rise to the drive mechanism, but at the opposite end from the drive a special down-take is required for the conveyor flights.

The scum cross-collectors are similarly grouped to collect the scum from two adjoining tanks. Furthermore, the collector in the southerly tank of each pair is extended so as to cross over the space between the two tanks and add its load of grease and scum to that from the northerly tank. This combined load is conveyed to the head end of each alternate tank by a single, narrow conveyor operating in a channel only 10 in. wide, which is hydraulically part of the basin itself and separated only by a steel side plate. In case of a temporary shutdown of one of these tanks, so that it cannot receive the grease and scum load from the adjoining tank, the design provides for a reversal of the direction of travel of the cross scum collectors in such a way that this load can be temporarily moved into the next adjoining tank. In the case of the most southerly tank, where this would not be possible, provision is made for temporary storage of the grease and scum, which is pushed by the flights of tank No. 6 into a pit constructed in the space between tanks 5 and 6, automatically draining into No. 6 and capable of taking care of an accumulation of approximately 60 cu ft.

By means of the three narrow return channels along the side of each alternate tank, all grease and scum are conveyed to each of three sludge and grease pumping stations without loss of head and with a minimum of difficulty from cold temperatures, since it is all floated on the main tank.



SCHEDULED FOR REMOVAL—OLD RACKS OF CAGE-ELEVATOR TYPE AT EXISTING NUT ISLAND WORKS

At the discharge end of this special narrow conveyor, the grease and scum flow over a tipping weir manually adjusted from time to time as required. The discharge from this weir impinges against the smooth slender tines of a small rack, which returns any large floating debris by way of a sluiceway to the main trunk sewer. In this way any sticks, rags, or such that get through to this point are passed through the comminutors again.

The grease and scum from each pair of tanks are discharged over the tipping weir into a sump 10 ft long, $7^1/_2$ ft wide, and about 10 ft deep. The connection from this sump to the pump suctions is from the bottom of a 3-ft square well at one side, which is separated from the sump by adjustable shutters which automatically skim off the top of the sump contents to any desired depth. The bottom of the main sump is connected by a riser, inclined as necessary but straight for rodding purposes, by means of which this grease and scum sump, when full or nearly full, is continuously self-draining into the main trunk sewer in such a way that the decant liquor is used to sluice any remaining sticks, rags, etc. (previously referred to), back through the works.

In each of the three pumping stations there will be three pumps of 200-gpm capacity. Two of these pumps will be of the "screw-peller" type and the third of the triplex plunger type capable of building up additional head as required. These pumps will be so connected that any one of them can take suction from the grease and scum sump or from either of the sludge sumps. Their capacity is sufficient so that two of the three pumps in one station need to pump sludge only about 15% of the time. The diameter of the force mains from the pumps to the digesters is only 6 in., providing for the maintenance of a velocity of about 2.3 ft per sec. Two parallel mains will be laid in the form of a loop, with provision for frequent routine passage of a cleaner of the go-devil type. This cleaner will cover the complete loop, from the discharge end of the sludge and grease pumps to the distributing valves in the digester building. Provision is made for storing the go-devil in an easily removable section of pipe in a bypass off the loop, but it is expected that most of the routine work of such cleaning will be done without the necessity of opening up the pipe.

EFFLUENT CONDUIT

The effluent conduit from the sedimentation tanks presents no unusual features except that it is subject to twice-a-day flushing at low tide. For a portion of its length this conduit parallels the venturi-meter section of the influent conduit. Taking advantage of this fact, a spillway is provided to take care of any surges in the influent line which could result from failure to properly coordinate the operation of the main pumping units with the manipulation of control shutters at the aeration channels. Also provided is an emergency spillway from the effluent conduit to an offshore outlet which would allow, even during extreme high tides, the maximum rate of flow to be put through the entire works. This off-

shore outlet consists of a 60-in. conduit extending through the embankment, and protected by a loose-fitting tide gate at the outer end, mainly to prevent tampering and to keep out cold air when the gate is exposed at low tide under extreme weather conditions.

After the effluent is returned to the sewer by way of the existing sand catcher, it is discharged in the same way that the raw sewage was originally, and under the control of the existing gates in the old screen house so-called. Partitions will be built to isolate these control gates in one room, and the present boilers in another. The remainder of the first floor of the building, after the removal of the existing cage-elevator racks, will be remodeled to house the chlorinating plant. There will be three storage galleries, each 42 ft long by 11 ft wide, and each with an outside entrance. Scales at the inner end of each gallery will handle standard chlorine drums, 30 in. in diameter by 7 ft long.

The dosing plant includes four 6,000-lb chlorinators. Chlorine will be fed during the summer recreational season at a point about 250 ft upstream from the control gates on the outfalls so as to provide opportunity for mixing before sampling at these gates. The design also includes provision for applying chlorine to the influent.

The second floor of the remodeled building will contain the administrative offices and chemical laboratory.

The construction of means for more effective dispersal at the discharge end of the two main outfall pipes will have to be done in about 30 to 40 ft of water and without interruption or undue interference with the use of at least one, and probably two, of these outfall conduits. At present a 90-deg, 60-in. elbow looks up at the end of the line, surrounded by stone paving. It is proposed to cap this outlet by placing a thin, flat dome about 16 ft in diameter above the center, from the edges of which a large number of beams will extend radially in all directions to cover an area about 38 ft in diameter (Fig. 1). The effluent will then be forced out over a large area and divided among a great many small openings between the radial members.

It is proposed to build the central dome on a barge and to handle it in place with a floating derrick. The beams will be pre-cast and laid down to fit the outer contours as they are found, and protected at the outer edge by bags of concrete as required. This design provides a fairly smooth protuberance over which any ship's anchor can drag harmlessly. Also, it should be sufficiently responsive to any local thrust or any excess pressure that could possibly develop to permit any of the pre-cast beams to swing upward as though hinged at the rim of the central dome. This design provides a total cross-sectional area in the tapered radial slots at least 12 times as large as the area of the 60-in. outfall pipe, and allows sea water to enter radially and mingle thoroughly with the rising effluent.

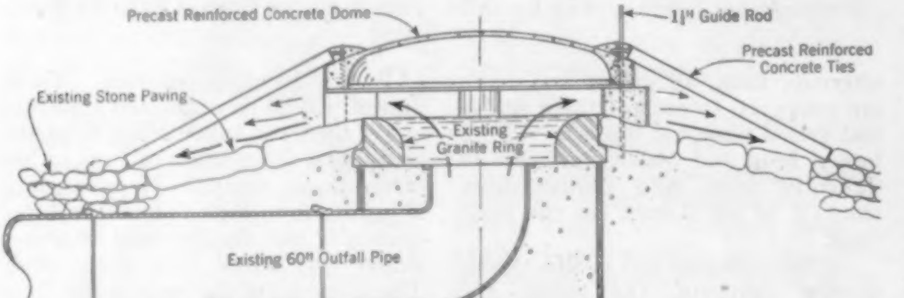


FIG. 1. DIFFUSER AT END OF OUTFALL LINE

SLUDGE DIGESTION TANKS

The raw sludge is pumped to digestion tanks 110 ft in diameter, with a 30-ft side-wall depth, each having a working capacity, full, of 2,300,000 gal. Two tanks with fixed covers will operate as primary digestion tanks, and two with floating covers as secondary digestion tanks. These four digestion tanks are expected to function, under different rates of flow, as shown in Table II.

The contents of the tanks are heated by continuous circulation through a battery of two sludge heaters. Heat is supplied by water circulated from the gas-engine jackets. It is proposed to maintain the temperature in the digestion tanks at 90 F. To maintain an even temperature in the system, heat exchangers are provided, one for cooling when the heat produced by the engines is more than that required by the digesters, which will happen in summer; and one to provide additional heat when the digesters demand more than is produced by the engines. The cooling medium is sewage effluent. The steam for the heater comes from the plant heating system fed by two boilers in the existing rack house and an exhaust boiler on the gas-engine generator unit. The circulated sludge enters each of the primary tanks at four points about 18 in. below the operating level. At four other points provision is made for circulating hot supernatant liquor through nozzles impinging from above at 45° on to the scum surface. The circulated sludge is drawn off at a point 10 ft below the operating level. A provision is also made for drawing off scum at a point 3 ft below the operating level.

Similar connections are provided for the circulation of sludge in the secondary tanks. The primary tanks automatically overflow to the secondary tanks, the surplus being drawn from various levels. The plant effluent is used for various purposes, including make-up water to the primary digestion tanks, sluicing water for screenings, cooling water for heat exchangers on the engine-jacket circulation system, and water for a yard system for flushing scum collectors.

In the center of the tank group will be the digester control building. It will have two floors, the upper of which will be a gallery or mezzanine, having a central opening through which daylight from a roof skylight will be admitted to the lower floor.

The digested-sludge disposal line will be a 12-in. pipe laid across the harbor to Long Island, thence along the shore of Long Island, and out into deep water in President Roads, as shown in Fig. 2. On Long Island, provision will be made for receiving similar sludge when the City of Boston constructs treatment works at the Moon Island outlet of the Boston main drainage system. A continuous flow of sewage effluent will be maintained in this line by pumping from the effluent conduit with three pumps that can be connected in series if necessary. Other pumps drawing from the bottom of the secondary digestion tanks will add their load of digested sludge commencing about two hours before high tide, so that the entire load of digested sludge will be discharged at the outlet end on the early stages of the outgoing tide.

In this way, the velocity in the line will be maintained fairly close to, or above 2.5 ft per sec, and the sludge will flow in the line at a moisture content of about 98%. This line is

equipped to take a cleaner of the go-devil type the same as the raw sludge lines previously described. Although it is not expected that such frequent cleaning will be necessary in this case, the line is equipped for it if required.

POWER PLANT INSTALLATION

The power plant consists of one 600-kw gas-engine generator unit, two 600-kw dual-fuel engine generator units, and two 210-hp dual-fuel engines direct-connected to blowers of 5,000-cu ft per min capacity. The gas engine will operate solely on digester gas. The dual-fuel engines will run on digester gas or oil or both, in any proportion from 95% gas and 5% oil to 100% oil.

All power and light required will be generated in the power plant. All machinery will be driven by electric motors with the exception of the blowers. The gas-engine generator unit will be capable of carrying the entire electrical load for better than 90% of the time, and gas production should be practically always more than is required to operate this unit. The two dual-fuel generator units will be available for use at higher loads and during periods of gas deficiency. Together they will be able to operate the entire plant up to the maximum sewage flow of 300 mgd during the starting-up period when no gas will be available.

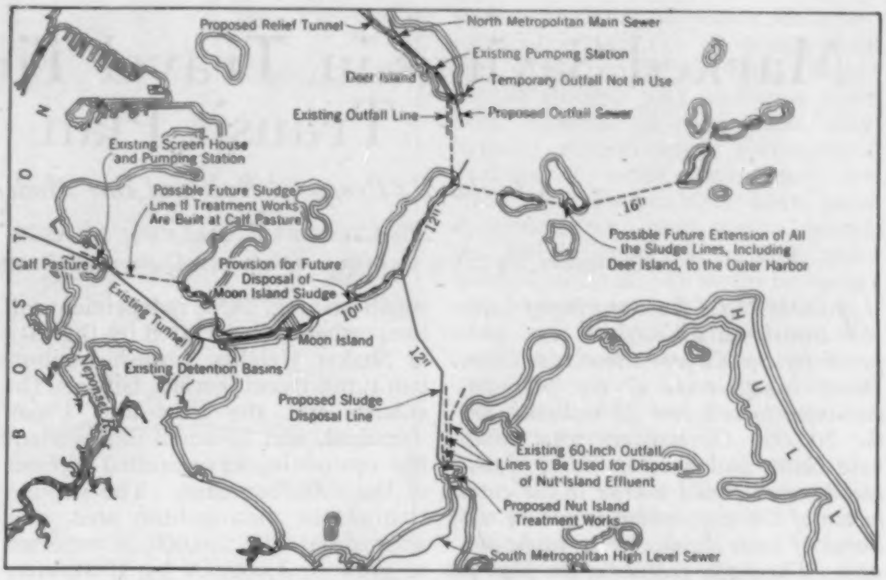


Fig. 2. Sewage Disposal Facilities in Boston Harbor Area

gas in a pressure sphere, which will feed it into the low-pressure system when the rate of consumption exceeds the rate of production.

HEATING AND VENTILATING

Existing boilers in the rack house will be converted to operate at not over 15 lb per sq in. Condensation in the heating systems of the main building, the administration building, the digester control building, and the gas control building, will be automatically returned to the boiler. The boilers will be fired by burners using either gas or oil. For ventilation in the main building, air will be drawn down through the grit-collection control room into the grit channels at the upstream end, and down through the comminutor room into the grit channels at the downstream ends. The air will then be drawn along each grit channel in two directions to ducts leading upward to the main header, whence it will be exhausted by fans through the grit-tower roof.

Table II. Functioning of Four Digestion Tanks

	Under Present Conditions		Under Design Conditions, About 1960	
	Normal Dry Summer Weather*	Average	Normal Dry Summer Weather*	At Design Rate of 112 Mgd
Approximate solids daily in digested sludge (60 to 65% of those in the raw sludge)	57,000 lb	51,000 lb	67,500 lb	56,500 lb
Digested sludge removed (at 92% moisture)	84,000 gal	75,000 gal	100,000 gal	82,500 gal
Supernatant liquor	126,000 gal	114,000 gal	150,000 gal	126,000 gal
Daily gas production (at 0.75 per capita)	.....	525,000 cu ft	.....	675,000 cu ft

* Such as affects recreational use of harbor.

Gas lines from each of the four digesters will be connected not only to the power plant and the gas control building, but also to the boiler room in the administration building or reconstructed rack house. In this boiler room, a small booster compressor will take the gas from the low-pressure system and compress it to about 9 lb per sq in. for burning under the boilers. The engines will draw gas direct from the low-pressure system through pressure-regulating valves. The gas control building will be provided with compressors and automatic controls which will maintain pressure in the low-pressure system within narrow limits. This control involves the storage of surplus

In a location southwest of the Administration Building it is intended to provide for dewatering and possibly drying a part of the digested sludge, so that it may be available as humus, mulch, or low-grade fertilizer to the Metropolitan District Commission, park departments of various municipalities, and others.

The dewatering of sludge would probably be done most advantageously by a mechanical vacuum filter, installed in a separate building. Elutriation preceding the dewatering would then be provided in special tanks adjacent to the building. A flash drier and other equipment could also be installed in that same building for drying all or a part of the sludge that had been dewatered. This drying could be regulated to use any surplus gas from the digesters, and generally might be limited to times when such a surplus would be available. At the Nut Island site, there is only limited space for the storage of dewatered or dried sludge, but more space is available near the present pumping station on Houghs Neck, where sludge might be disposed of either in open or covered storage piles. It is not proposed to make any provisions for processing more than 10% of the digested sludge for this purpose.

The engineering staff of the Metropolitan District Water Supply Commission includes Stanley M. Dore, Assistant Chief Engineer, and Lawrence M. Gentleman, Associate Civil Engineer, both Members ASCE, and Walton H. Sears, Mechanical Engineer, who have been most helpful in the preparation of this paper.

The Commission consists of William T. Morrissey, chairman, Edward J. Kelley, Louis B. Connors (who has just succeeded the late Charles H. Brown), Arthur D. Weston, and Thomas A. Berrigan, the last two being Members ASCE.

Marked Savings in Travel Time Featured in Transit Plan

Cleveland's Proposed Rail and Bus Modernization

By Charles E. DeLeuw, M. ASCE
President, De Leuw, Cather and Company, Consulting Engineers, Chicago, Ill.

A COMPLETE revamping of basic transit facilities has been proposed for the City of Cleveland, Ohio. Direct beneficiaries of the program, estimated to cost over 22 millions, are the 100,000 Clevelanders who would have better and quicker rides. Indirect benefits would accrue to the commerce of the city, which would be relieved of costs chargeable to traffic tie-ups. The major feature of the plan is a downtown subway to relieve surface streets of the transit load.

NEW bus and rail rapid-transit facilities proposed for Cleveland, Ohio, would provide convenient and direct transportation of passengers and at the same time bring much-needed relief to the city's crowded thoroughfares. For maximum benefits to street traffic, the proposal would take rail traffic underground in the downtown area. This plan (Fig. 1) is the outgrowth of a survey to determine origin and destination of present and potential passengers of the Cleveland Transit System.

A unique problem was faced by engineers in this complete rehabilitation of transit service to outlying sections of Cleveland's metropolitan area, and results give promise of welding rail and bus lines into a single efficient operating system. The area served includes the 73.4 sq miles of the fan-shaped city, with its central business district located near the shore of Lake Erie. It is surrounded by a number of populous suburban communities which contain a substantial portion of the metropolitan population. The topography of Cleveland provides for the natural segregation of industrial from residential areas. Industry has tended to locate in the central valleys, leaving ample space for attractive residential areas on the higher land to the east and west. The street pattern is better than the average, and Cleveland is fortunate in the liberal width of some of its major thoroughfares, particularly in the downtown district.

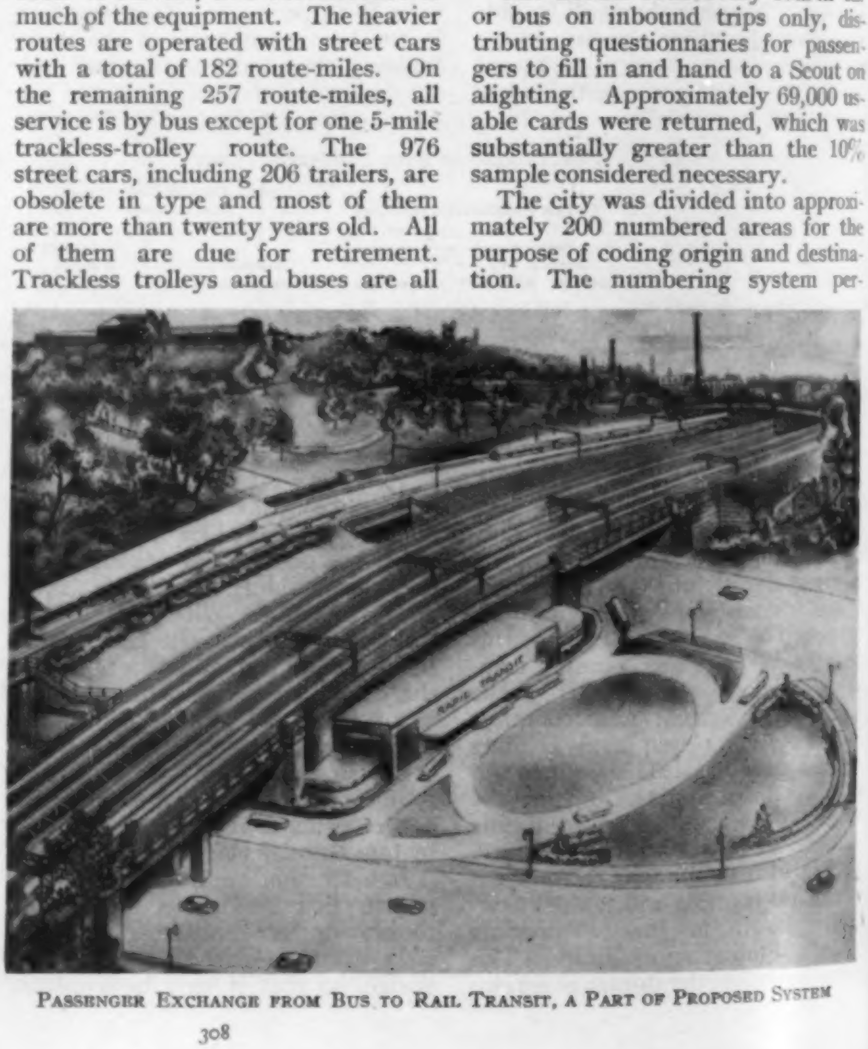
The Cleveland Transit System (C.T.S.) operates most of the public transportation facilities in this metropolitan area. One independent rail line, owned and operated by the City of Shaker Heights, furnishes suburban rapid-transit service between the suburb and the Cleveland Union Terminal, and 15 small independent bus companies serve limited sections of the suburban area. The population of the metropolitan area, now approximately 1,250,000, is expected to grow to 1,500,000 by 1960, after which further increases will be moderate.

All the present C.T.S. service is furnished by local lines extending out from 10 to 15 miles from the downtown district except for three express bus lines. The existing transit system is unsatisfactory from the viewpoints of travel time required, character of service, and obsolescence of much of the equipment. The heavier routes are operated with street cars with a total of 182 route-miles. On the remaining 257 route-miles, all service is by bus except for one 5-mile trackless-trolley route. The 976 street cars, including 206 trailers, are obsolete in type and most of them are more than twenty years old. All of them are due for retirement. Trackless trolleys and buses are all less than ten years old and modern in type, but some of this equipment is war-weary and is scheduled for replacement.

While considerable information was at hand relating to the operation of the transit system and the traffic on the several routes, no data were available covering the origin and destination of passengers. The C.T.S. undertook an origin-destination survey of its own passengers, therefore, as well as of those on the Shaker Heights Rapid Transit and on all independent bus lines in the entire metropolitan area. All the field work of this survey was carried on by the Cleveland Council of Boy Scouts, working under the supervision of transit-system personnel.

The Scouts rode every fourth car or bus on inbound trips only, distributing questionnaries for passengers to fill in and hand to a Scout on alighting. Approximately 69,000 usable cards were returned, which was substantially greater than the 10% sample considered necessary.

The city was divided into approximately 200 numbered areas for the purpose of coding origin and destination. The numbering system per-



Passenger Exchange from Bus to Rail Transit, a Part of Proposed System

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Fig. 1. Coordinated Rapid Transit System Recommended for Cleveland, Ohio

mitted breaking the city into ten large zones, one covering the central business district, four more covering an area within a four-mile radius of the central district, and five covering outlying areas. Boundaries of each of these larger zones, based on the street system and topography of the area, were selected to facilitate the analysis of several potential rapid-transit routes. All other information on the survey card was coded so that it could be transcribed to business-machine cards for analysis. The following summaries were obtained:

- Origin-destination by lines
- Origin-destination by entire system
- Origin-destination by hour of day
- Distribution of passengers by hour of day by line
- The transfer factor, or rides per passenger per line

The survey provided the factual base for the following estimates of probable traffic on the several branches of the proposed rapid-transit system:

Rapid-Transit Division	Daily One-Way Traffic
East Cleveland	32,200
Shaker Heights	12,800
Southeast	12,900
South	16,300
Southwest (Bellaire Road area)	7,000
Southwest (Lorain Avenue area)	7,000
West Cleveland	17,200
Total	105,400

The estimated schedule and equipment requirements for the rapid-transit system, express buses, and local buses were determined by analysis of the origin-destination by hour-of-day summaries. This study revealed the very high peaks, for instance, in individual sections on the outer west side, where the majority of passengers are employed in the central district. In certain west side areas, more than 24% of the total 12-hour one-way movement took place in one hour between 8:00 a.m. and 9:00 a.m.

Rail Lines to Be Completed

The plans of the Cleveland Terminal Railroad and the Nickel Plate Railroad made some 20 years ago for rapid-transit service to both the east and west sides of the city have been only partially developed in the operation of the existing Shaker Heights Rapid Transit (between the Union Terminal and 55th Street). The Nickel Plate Railroad made specific provisions for two-track urban rapid-transit service from 55th Street to Superior Avenue—4.95 miles northeast.

West of the Terminal, the Terminal Railroad has provided similar facilities as far as Fulton Road. On both sections, the grading has been largely completed and structures built in such a way as to permit the installation of rapid-transit equipment such as track, signal, power, and communication facilities at a moderate cost. On certain sections, rapid-transit stations and platforms have been constructed and lack only lighting, station finish, and control facilities to make them ready for operation. Foundations have been constructed and steel towers erected for trolley supports through substantial sections. It would be necessary to construct embankments and additional bridges, however, on the northeast route between Superior and Windermere, where no provision was made in the original plans for urban rapid transit.

Between Fulton and West 110th, the Nickel Plate Railroad built structures of sufficient width to accommodate two additional tracks throughout. Only a portion of the grading has been completed, however, and two additional bridges are required.

The two-track railroad now utilized by the Shaker Heights Rapid Transit between 55th Street and the Union Terminal has capacity for substantial increases in traffic. Ample platform and stairway facilities in the Union Terminal would accommodate as much additional rapid-transit service as may be necessary.

Expressway Development

A comparatively recent development is the coordinated planning of highway and transit improvements so as to permit the most efficient use of highways by both passenger automobiles and public carriers. This policy has met with the approval not only of transit and highway officials, but also of the public at large. Plans for highway improvements, particularly expressways, to be built in the Cleveland metropolitan area are of special interest in the consideration of transit modernization.

The plans for the proposed freeways include seven arterial highways and a central interchange articulated by suitable circumferential routes. The total cost of the Cleveland program is estimated at $240,000,000. While this is an impressive sum, a start has been made through the county bond issue voted in 1940 in the amount of $4,500,000, a substantial portion of which has been used for the acquisition of right of way.

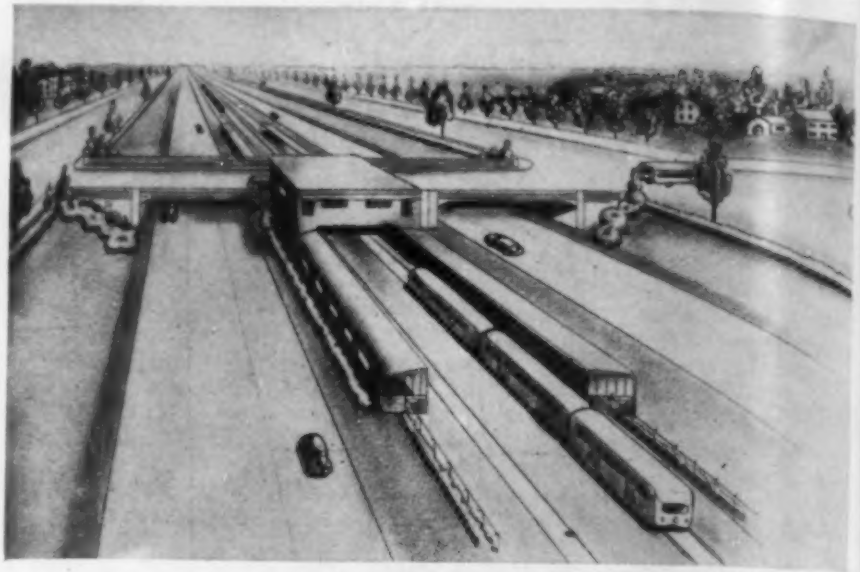
Rapid Transit Routes Studied

There is an opportunity for transit improvement through the completion of the expressway program. There are definite advantages in making use of suitably located expressways

for public transportation, not only to benefit the transit patron, but also to assure efficient use of these new facilities.

Of the individual routes studied, the only division with sufficient traffic to warrant rapid-transit operation was that to East Cleveland. The total traffic on all the rest of the lines, it was estimated, could be served adequately with express buses. It would be feasible, however, to route feeder buses to stations at 110th Street and 98th Street of the west route so as to provide improved service to the Lorain Avenue, Bellaire Road, and Puritas Avenue areas. This would bring the total west side traffic having destinations in or beyond the downtown district almost in balance with that from the east side.

A two-track rapid-transit route is proposed from Windermere Avenue on the northeast along the rights of way of the Nickel Plate Railroad and the Cleveland Terminal Railroad to 110th Street on the west, a total distance of 14.44 miles. Multiple-unit train operation between stub terminals is proposed. Station platforms would be at car-floor level. Virtually all the outlying sections on the east and west would be served through feeder bus routes operated through residential sections to convenient transfer stations on the rapid-transit line.



RAIL SYSTEM INCLUDED IN EXPRESSWAY PROGRAM

DOWNTOWN TERMINAL SUBWAY

An underground terminal route (Fig. 2) was planned along 14th Street and Huron Road with stations at 9th and Prospect as well as at 14th and Euclid. Existing station facilities in the Cleveland Union Terminal would provide a third downtown station, supplemented by a new pedestrian passageway for those transferring to local routes at the Public Square. This would avoid undue concentration of traffic in a single downtown station, and also would provide adequately and efficiently for the distribution of passengers throughout the central business district. This 1.52-mile terminal route is planned for cut-and-cover construction, at the highest practicable grade to provide for the maximum convenience of rapid-transit patrons as well as to reduce construction costs.

TRANSFER FACILITIES

The preliminary plans and estimates provide for the continuation of the present Shaker Heights Rapid Transit operation. As a practical matter, however, it should be operated as a part of the Cleveland Rapid Transit system. Coordination would provide many advantages from the viewpoint of scheduling service, providing transfer facilities, delivering passengers in the downtown district, and standardizing equipment.

Elaborate transfer facilities are planned at 98th Street and 110th Street on the west as well as at Cedar, Superior and Windermere on the east. Feeder buses would run to or through terminal loops with platform delivery at rapid-transit stations. The planning and building of both rapid-transit and feeder lines simultaneously permits the development of transfer facilities with a maximum of convenience.

Vastly improved rapid-transit bus service was planned on the lighter routes, to be operated initially over the street system and ultimately over expressways, to serve the rapidly growing districts to the southeast and southwest. Express buses could handle any predictable traffic from these areas. The maximum daily one-way traffic on the heaviest of these express bus routes, as determined at the 1945 traffic level, was a total of 16,300 passengers. This volume, even if it is increased substantially in future years, would still be well within the limits of practicable operation of rapid-transit buses on an expressway.

BENEFITS OF RAPID TRANSIT

There would be countless advantages from the viewpoint of the transit passenger, the operator, and the public at large from the development

FIG. 2. DOWNTOWN SUBWAY ROUTES—COMPLETE RECOMMENDED PROGRAM

of rapid-transit service in Cleveland. The transfer of substantial volumes of transit traffic from the street system to private rights of way would materially benefit all street traffic. Safety would be enhanced. Sheltered stations would be a definite convenience to the passengers during the inclement weather. The regularity characteristic of rapid-transit operation would be appreciated by all patrons of the system.

Perhaps the most important, and certainly the most tangible benefit of all, would be the marked savings in travel time. Service would be much faster with stations spaced a half mile or more apart and with operation by modern, light-weight trains capable of crest speeds of upwards of 50 miles an hour.

SAVINGS IN TRAVEL TIME

Estimates of the travel time for the modernized system, making due allowance for the time required to transfer from feeder lines to rapid transit, show overall reductions in travel time ranging from 17% to 48% in the various areas served.

One of the more important facts disclosed by the survey was the spread of destinations of passengers from all sections of the city through the entire central area. Present routings to the Public Square provide adequately for the delivery of passengers from the east side. Passengers from the west side, however, are forced to transfer or walk in order to reach destinations in the vicinity of East 9th and East 14th streets.

Some of the major transit routes would be relieved of substantial volumes of traffic through the operation of trunk-line rapid-transit service, but there would still be some need for distribution of transit vehicles over the downtown streets in the interest of reducing traffic friction to a minimum. In addition, certain sections of the central area are now virtually without transit service. The rapid-transit route along the southerly boundary of the central business district would also be balanced by routing local bus and trolley-coach routes through the northerly section of the district.

The report recommends operation of local routes from the west and southwest sections of the city to an off-street bus terminal located in the vicinity of East 13th Street and Chester Avenue. An enclosed terminal building would provide for the layover of buses and also would add greatly to the convenience of passengers. The suggested location is close to Euclid Avenue. Through the cooperation of the various commercial establishments in this area, a covered arcade or passageway could be furnished from the bus terminal to a point near the important Euclid Avenue–East 14th Street intersection.

COST ESTIMATED

Estimated costs of the several capital improvements required for rapid-transit operation as here proposed are summarized as follows:

Downtown terminal subway	$12,600,000
Rapid-transit facilities on railroad rights of way, shops, and terminals, and pedestrian passageway from Terminal Building to Public Square	9,900,000
Total	$22,500,000

Engineers' Notebook

Suggestions and Practical Data Useful in the Solution of a Variety of Engineering Problems

Channelized Intersection a Lifesaver

By Harry S. Wright

Traffic and Safety Engineer, Utah Highway Commission, Salt Lake City, Utah

Major highway accidents at the intersection of two main routes in Salt Lake City have been effectively eliminated by confining traffic in channels especially designed for the unusual conditions encountered. For many years, an unhealthy condition has existed near the north entrance to Salt Lake City, where a main through highway and a local highway intersect (Fig. 1). The intersection is on a curve near the top of the grade for the main highway and at the beginning of a plus grade for the minor highway. In addition, the intersection of these two highways is at an acute angle over a considerable distance and is very wide at the point of intersection. Approach speeds for north- and southbound traffic on the main highway are high.

The daily average of motor vehicles on the main highway was found to be 7,750±, and that on the intersecting or minor highway, 1,900±. An average of 950 southbound cars turned left into Victory Road, leaving the lane of fast southbound cars, which averaged 3,875 daily, and crossed through a like number of fast, northbound vehicles, this crossing being done in a meandering manner over a distance of about 500 ft. The 950 northbound cars on Victory Road, after stopping a considerable distance from the line of the fast northbound traffic traveling on U.S. 91, entered into this traffic stream at a much lower rate of speed and in a meandering manner over a distance of about 500 ft. The result can well be guessed.

First, there were many rear-end collisions for those turning left when leaving the lane of fast southbound traffic, and head-on collisions for the same group as they attempted to crash the fast northbound traffic. At all times they were subject to someone's crashing into the front or rear end while they stopped, awaiting an opportunity to pass through. Second, many rear-end collisions and sideswiping collisions were suffered by the northbound cars that left Victory Road. Third, head-on, side-smashing, and rear-end collisions were suffered by light southbound vehicular movement on Victory Road that turned left onto the main highway.

SIGNS, CHANNELS, AND LIGHTS

This problem was solved by constructing a channelized neutral zone with reflecting curbs to direct and divide traffic. Proper signs were placed to warn and direct the traffic, and at locations which give drivers sufficient time to react and obey. Sodium vapor luminaires were installed to make this intersection clearly visible at night. It will be

noted from Fig. 1 that a deceleration lane is provided to allow the southbound traffic on U.S. 91, the main highway, to make a left-turn movement onto Victory Road by pulling out of the line of the fast traffic into a fully protected zone. The island is of sufficient width to protect both the rear and the front of these vehicles while they stop and wait for an opportunity to cross through the fast northbound traffic. Also, their point of crossing is confined to a very limited area, thus eliminating confusion from the minds of both north- and southbound motorists as to the point of crossover.

This same general pattern is followed in protecting northbound vehicles from Victory Road when they make a left turn onto U.S. 91 and continue south. They are channeled through a limited area toward their destination and are protected by the raised neutral zone from oncoming fast traffic. Northbound drivers from Victory Road that are continuing northward along U.S. 91 are required to come to a full stop at a point near the lane of the northbound main traffic. They are protected from the former meandering fast northbound traffic through channelizing of that traffic. The raised neutral zone also protects them from the danger of cars crashing head on into the sides of their vehicles. In addition, this movement of traffic is provided with an acceleration lane that enables it to gain a speed approximating that of the main northbound movement before entering it, thus greatly reducing chances of rear-end collisions.

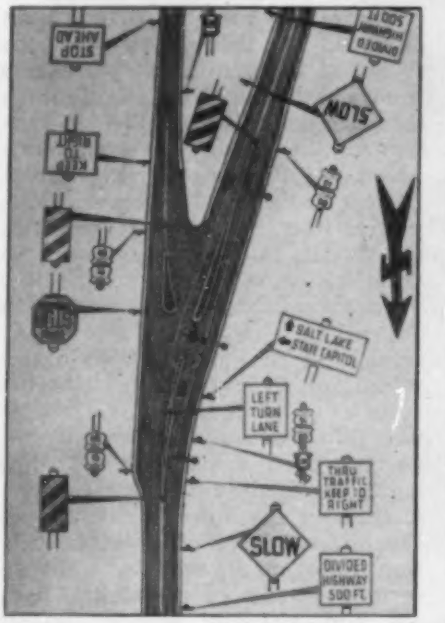


FIG. 1. INTERSECTION WITH CHANNELS, SIGNS, AND LIGHTS PROVIDED TO CUT TRAFFIC ACCIDENTS

Note also that valuable and simple signs were installed as the medium for telling the traveling public the rules to follow to ensure safe travel through this intersection. These signs are all area-reflectorized so that they are clearly visible during the night hours as well as during daylight. The curbing around the islands is also reflectorized. This gives the impression at night that the curbs are illuminated, and clearly outlines the island to drivers as they approach it.

Sodium vapor lights illuminate the entire intersection in a manner that makes it clearly visible from all approaches. This installation achieved its goal—to carefully channelize traffic without confusion—and has cut the number of accidents at this point to two since June 1945, during a time when traffic increased greatly.

Two-Compartment Cell Softens Water Electrolytically

By LEE STREICHER

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REDUCED costs of domestic, industrial, and municipal water softening and partial demineralization have been found possible by operating records of an experimental two-compartment electrolytic cell built at the plant of the Metropolitan Water District of Southern California. The new unit, designed by R. E. Briggs, Industrial Chemist, produces a soft water at lower power cost and with a lower percentage of waste water than has formerly been possible with the three-compartment cell.

Basic elements of the two-compartment cell are shown in Fig. 1 (*a*). From this diagram it can be seen that, since only one diaphragm is used in the basic cell, there is no center compartment for the separation of neutral, demineralized water. In this, as in the earlier three-compartment cell (Fig. 1, *b*), the anolite (solution in the anode compartment) becomes quite acid while the catholite becomes alkaline, because of ion migration under the electrolytic influence. But, whereas the three-compartment cell made use only of the phenomenon of ion migration, the two-compartment cell, in addition to this, utilizes the chemical precipitation of calcium and magnesium, which takes place in the cathode compartment, to achieve the hardness reduction desired.

In other words, full advantage is taken of the fact that calcium carbonate and magnesium hydroxide will precipitate from a solution at the proper pH value. The cathode water, instead of being wasted as it is from the three-compartment cell, is here considered as the ultimate finished product in the first stage of treatment. The anions (sulfate and chlorides) have been reduced by ion migration while hardness-forming cations (calcium and magnesium) have been reduced by precipitation. The carbonates and bicarbonates are also reduced during the calcium precipitation.

From the electrolytic unit, the caustic catholite is passed into a settling basin where the bulk of the precipitated calcium carbonate and magnesium hydroxide are permitted to

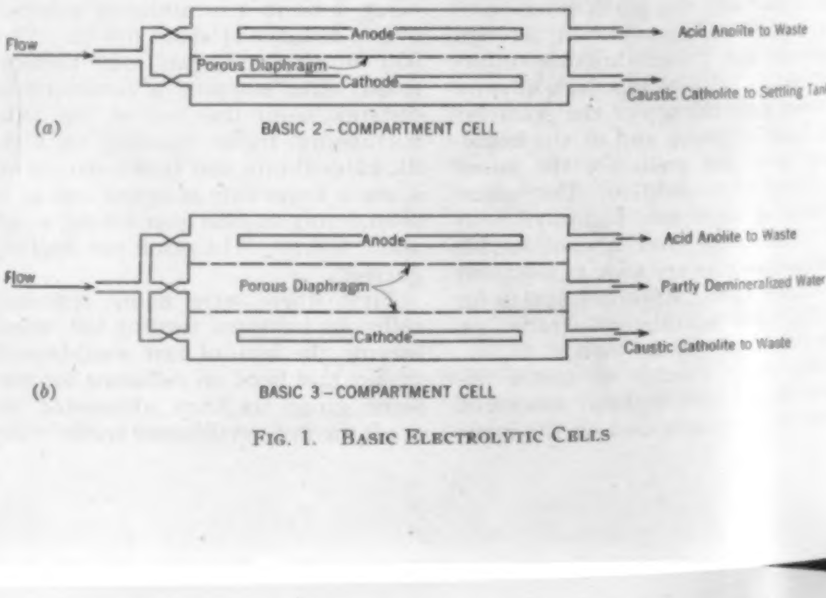

FIG. 1. BASIC ELECTROLYTIC CELLS

Experimental Softener Built for Domestic Use

settle out. Any precipitate remaining after the clarification may be removed in a conventional sand filter. The pH of the water may be adjusted to any desired value by either of two means: (1) carbonation followed by secondary clarification prior to sand filtration, or (2) through the use of a secondary electrolytic unit in which the pH reducing effect in the anode compartment rather than the alkalizing effect in the cathode compartment is utilized. The final product is a soft water, reduced in dissolved solids, and produced at a lower power cost and with a lower percentage of waste water than is possible with the three-compartment cell.

The experimental unit, consisting essentially of a number of two-compartment cells arranged in parallel (Fig. 2), was built at the water softening and filtration plant of the Metropolitan Water District. Mr. Briggs, the designer of the unit, with the cooperation of the softening plant laboratory staff, conducted a series of tests designed to determine: (1) the quality of finished water that could be obtained through treatment of raw Colorado River water by the electrolytic process; (2) the current requirement for various degrees of treatment; (3) the operating conditions most favorable for efficient electrolytic softening; (4) the size of unit necessary for a given capacity; and (5) the approximate cost of construction of such a unit.

No attempt will be made, in this brief discussion, to present details of construction or operation of the experimental unit used. Data are included, however, giving pertinent facts relating to quality of water produced, and current used per 1,000 gal for various degrees of treatment.

Table I shows the relationship between the quality of water produced and the current used per 1,000 gal. One point worthy of particular note is the reduction in dissolved oxygen effected during the electrolytic treatment. If proper advantage is taken of this accomplishment, corrosion in the treated water system can be markedly reduced.

It might well be mentioned at this point that, by suitable selection of operating conditions, either the anion reduction or the softening effect may be given precedence in the treatment, within certain limits. Thus, with the same power input, the hardness of the finished water may be varied as much as 20% with a corresponding, but opposite in direction, variation in the anion reduction. This provides a definite, though limited, flexibility in selecting the influence to be preferred in the treatment of any water.

Table I. Quality of Water Produced by Electrolytic Softening Process, and Power Requirements

Constituents	Raw Water	Electrolytically Softened Water A	B	C	D
Total dissolved solids	770	520	509	499	519
Specific conductivity ($K \times 10^4$)	122	87	82	81	84
Total hardness as $CaCO_3$	370	146	126	120	99
Carbonate hardness as $CaCO_3$	118	11	14	32	99
Non-carbonate hardness as $CaCO_3$	252	135	112	88	0
Silica	2	1.5	1.5	1.5	1.5
Calcium	92	43	44	44	37
Magnesium	34	9.5	4	2.5	1.5
Sodium & potassium	117	117	118	119	147
Carbonate	0	0	0	10	0
Bicarbonate	144	13	17	20	192
Sulfate	360	282	268	251	192
Chloride	93	69	65	61	44
Alkalinity, phenol.	0	0	0	8	0
Alkalinity, total	118	11	14	32	157*
pH	8.2	8.5	8.6	9.5	8.3
Dissolved oxygen	9.0	2.6	2.2	1.8	..
Ampere hours per gal	..	0.60	0.70	1.05	1.75
Kwhr per 1,000 gal @ 4 v		2.4	2.8	4.2	7.0

* High alkalinity due to use of carbonation for final pH adjustment.

This brief discussion may present a very bright picture for the future of the electrolytic process of softening water. Perhaps this may prove to be the case. Certainly, the process provides a means of producing satisfactory treated water from raw water supplies that are very difficult to treat by conventional methods. Only demineralization through ion exchangers can offer a comparable treatment, but apparently at a considerably higher cost. It must be borne in mind, however, that further experimental work must be done to determine the practicability of this method, particularly for municipal use. Experimental units for industrial and domestic application have been operated by Mr. Briggs for some time, and the prospects appear promising for full development of these types in the relatively near future. For installations of the magnitude required for municipal water treatment, additional studies will have to be completed relative to cost of construction, probable length of life of materials used, ease of operation, and general maintenance requirements.

This is a shortened form of the paper presented by Mr. Streicher before a recent meeting of the Los Angeles Section of ASCE.

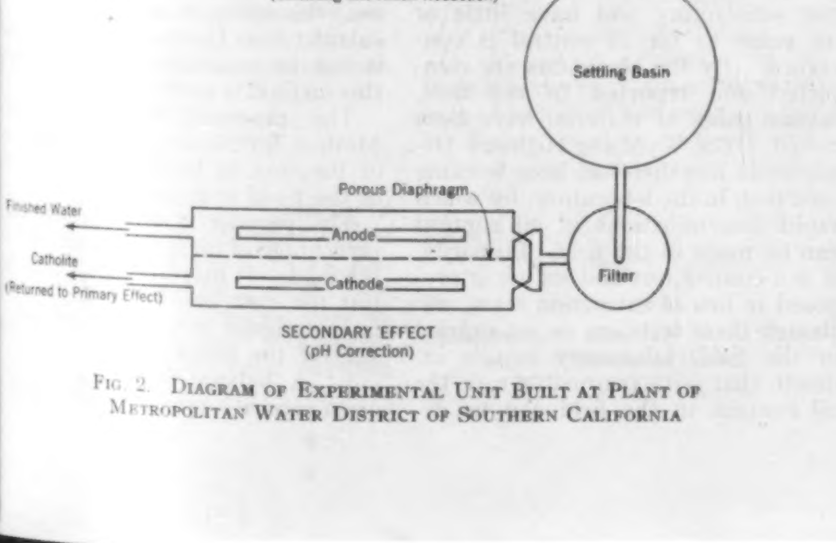

Fig. 2. Diagram of Experimental Unit Built at Plant of Metropolitan Water District of Southern California

How to Install a Drain—One Easy Lesson

WHEN the Standard Construction Company of Duluth, Minn., was engaged to install a 36-in. drain pipe along the Northern Pacific Railway near St. Paul, Minn., a single track-type tractor, with attachments, performed all the major tasks of the construction, as illustrated by the photographs below.

(1) Utilizing the double-drum winch with a dragline bucket, the tractor operator dug out the deep ditch required to install the pipe beneath the railroad tracks.

(2) Unhitching the dragline, the operator simply bulldozed the 36-in. tile into the ditch.

(3) Then the pipe sections were winched into position. Finally it was a simple matter to bulldoze the excess earth into the fill.

Rapid Method Determines Bitumen in Road Mixes

By M. A. VER BRUGGE

MATERIALS ENGINEER, WYOMING HIGHWAY DEPARTMENT, CHEYENNE, WYO.

AN accuracy of within 0.1% in determining the oil content of road mixes is promised by a field test devised by the Wyoming Highway Department. The complete test can be made in 15 minutes under ordinary conditions on fresh mixtures in the field. This provides a new close control of proportioning in a carefully designed mix.

The control of oil-aggregate proportions in bituminous mixtures has always been a problem in the field, particularly where road-mix methods are used. Testing the consistency of the mixture by kicking the windrow, rubbing the material in the hands, by color, and by checking the oil tonnage against the gravel spread has been the basis of the engineer's judgment as to proper oil content. Fortunately, in most cases the results have been quite satisfactory. However, this obviously is a rather loose method of control.

Extraction tests now required are not satisfactory and have little or no value as far as control is concerned. By the time tests are completed and reported to the field, several miles of material have been mixed. The Wyoming Highway Department has therefore been working on a test, in the laboratory, by which rapid determinations of oil content can be made in the field. Primarily, it is a control test and its use is proposed in lieu of extraction tests. Although these tests are as yet untried in the field, laboratory results indicate that with reasonable care the oil content in the field can be determined within an accuracy of 0.1%.

Oil mixtures are designed in the laboratory on the basis of optimum oil content for maximum stability. It is desirable to keep the oil content near this optimum, especially in critical mixtures. The accuracy with which it can be controlled in the field by this method is entirely satisfactory.

The proposed Wyoming Rapid Method for Determining Percentage of Bitumen in Bituminous Mixtures in the Field is as follows:

The purpose is to determine the percentage of oil in fresh mixtures in the field. It may be used as a check test for close control of proportions in a designed mix. Apparatus consists of the following:

1. A balance of at least 1,000-gram capacity, sensitive to 0.5 gram

2. A flask of the Chapman type, having two bulbs with a graduate stem above the bulbs and a heavy base. The lower bulb contains 600 ml, the upper bulb 350 ml, and the stem is graduated from 350 ml to 425 ml, in 1-ml divisions. The inside diameters of the stem and the neck connecting the bulbs should be not less than 2.5 cm.

3. A thermometer having a range from zero F to 220 F.

The flask is filled to the 600-ml mark with kerosene or any other solvent of low volatility having a gravity within the range 35 to 50 deg API at 60 F. The temperature of the solvent is taken and noted. A representative sample weighing 1,000 grams is taken from the prepared windrow ahead of the mixing operations and introduced into the flask. After rolling the flask in an inclined position and whirling in a horizontal circle until no further air bubbles rise to the surface, a reading is taken on the stem and the displacement noted. The temperature is again noted and if there is any appreciable change (±2 F), a correction of 0.3 ml is applied for each degree of difference in temperature. This correction is added if the latter temperature is lower or subtracted if it is higher. This will give the net displacement of the sample of unoiled material. The flask is then emptied and thoroughly cleaned.

Next a representative sample of the oil-mixed aggregate weighing 1,000 grams is taken, following the completed mixing operations, and at approximately the same location at which the unoiled sample was taken. The above procedure is repeated. This will give the net displacement of the oiled sample.

When the oil used in the mixture has a specific gravity other than 1.000, the volume must first be determined and converted to weight. The volume of the oil in the mixture is determined from the following formula:

$$Vo = \frac{S(Dw - D)}{S - Go\,D} \quad . \ . \quad (1)$$

in which

Vo = volume of oil, in ml
Dw = net displacement of oiled sample, in ml
D = net displacement of unoiled sample, in ml
S = weight of sample, in grams
Go = specific gravity of oil used, at time of test

$$W = Vo \times Go \quad . \ . \ . \quad (2)$$

in which W = weight of oil

$$\%\text{ oil by weight} = \frac{W}{S - W} \times 100 \quad (3)$$

The complete test can be made within 15 minutes with relatively non-absorptive aggregates, and within 30 minutes with highly absorptive aggregates.

This test has been accepted by the Public Roads Administration, in lieu of the extraction test, on projects in Wyoming in which there is federal participation.

Our Readers Say—

In Comment on Papers, Society Affairs, and Related Professional Interests

Factor of Safety in Stability Analyses

TO THE EDITOR: The analysis of the stability of an earth slope for a given set of conditions involves the determination of the factor of safety against failure by a slide. In making stability analyses over the past few years, a question has gradually arisen in the writer's mind regarding the definition of the factor of safety to be used. Since basic concepts seem to be involved in this definition, the writer will present them for the consideration of those interested in problems of the stability of earth slopes.

According to the usual concepts, the factor of safety of the earth slope in Fig. 1 against failure by a slide is defined by Eq. 1.

$$\text{Factor of safety} = \frac{c\,L\,r}{W_1 l_1 - W_2 l_2} \quad . \ (1)$$

The mass W_1, actively tending to cause sliding, lies to the right of the center line in Fig. 1 with a positive moment arm. But according to the new concept, the writer regards the mass W_2 to the left of the center-line with a negative moment arm as a counter-balancing or stabilizing force which, together with the shearing resistance c that can be mobilized along the length L of the sliding curve, tends to resist sliding. Thus the mass forces involved may be regarded as active sliding forces and passive stabilizing forces, as shown in Fig. 1.

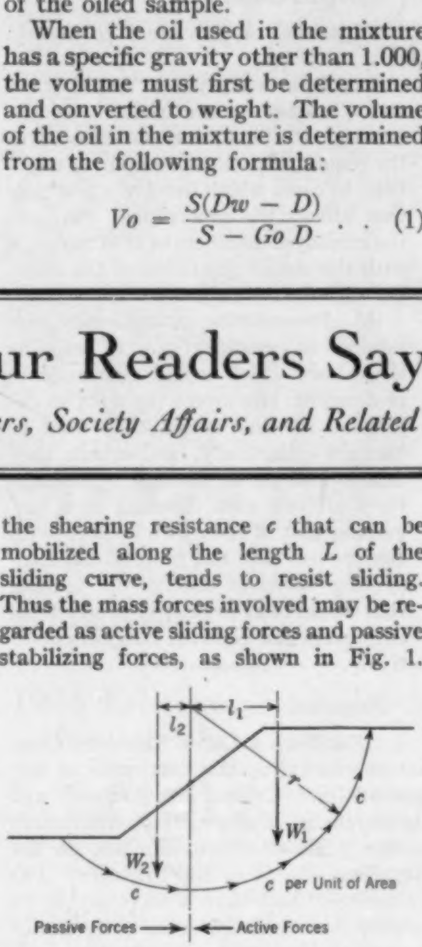

FIG. 1

From this viewpoint, the writer would be inclined to write the moment equation of equilibrium, as given in Eq. 2, and to define the factor of safety in accordance with Eq. 3.

For stability:

$$W_1 l_1 = W_2 l_2 + c\,L\,r \quad . \ . \ . \ . \quad (2)$$

Factor of Safety (FS) =

$$\frac{\text{Moments of Shearing Resistance + Passive Stabilizing Forces}}{\text{Moment of Active Sliding Forces}} = \frac{c\,L\,r\;W_2 l_2}{W_1 l_1} \quad . \ . \ . \ . \ . \quad (3)$$

For situations involving both the natural shearing strength c of the soil and the angle of friction ϕ, the factor of safety is defined by Eq. 4.

$$FS = \frac{r(c\,L + \tan\phi\ \Sigma N) + W_2 l_2}{W_1 l_1} \quad . \ (4)$$

wherein ΣN is the total normal pressure on the surface of sliding.

The factor of safety thus defined by Eqs. 3 or 4, if it is greater than unity, is always smaller than that given by Eq. 1, as usually defined. This may or may not indicate a more critical condition. Probably smaller values than those usually considered satisfactory would be adequate. On the other hand, if the factor of safety is less than unity, it is always greater than that given by Eq. 1, which appears to bring the value of the factor of safety of actual failures more into line with the concepts of what a factor of safety really signifies.

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SOCIETY AFFAIRS

Official and Semi-Official

Engineer Labor Policy Proposed

By WILLIAM N. CAREY
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PROFESSIONAL engineering societies have struggled separately during the past few years to develop a policy and procedure with regard to labor laws and labor legislation. A few months ago, Engineers Joint Council was requested to try its hand at the job. Engineers Joint Council referred the question to its subcommittee on the "Economic Status of the Engineer" and this committee passed the ball to its subcommittee, the "Survey Committee on Collective Bargaining by Engineers in Professional Work."

The EJC subcommittee on "Collective Bargaining," of which E. P. Yerkes, AIEE, is chairman, pondered over the problem and consulted labor lawyers and a labor consultant. A proposed labor policy and procedure were referred to the Committee on Economic Status of the Engineer on May 21. With some revisions, the Economic Status Committee accepted and recommended the proposed policy to EJC on June 6, as follows:

POLICY ON LABOR LAWS AND LABOR LEGISLATION

It shall be the policy of the member professional societies in so far as legal limitations and finances of the societies permit:

A. General Policies

1. To concern themselves with both existing labor laws and proposed labor legislation to the extent that these affect professional employees.

2. To assist professional employees, either at the request of employee members or on the initiative of the societies themselves, in proceedings before any governmental agency, when such proceedings are caused by the impact of labor laws currently in effect and which involve a principle which might affect the professional status of employees.

3. To make their views known regarding specific modifications of existing labor laws which would protect the professional interests of the societies and their employee members.

4. To keep their members informed on existing labor laws, proposed labor legislation, and current developments in the field of collective bargaining that affect the economic status of professional employees.

5. To act jointly with respect to the above matters, but on a voluntary basis which will permit any society to refrain from participating with respect to a particular issue, principle, or activity.

B. Specific Policies

1. Establish a procedure to accomplish:

(*a*) Intervention as a "friend of the court," either on the initiative of one or more of the several societies or at the request of groups of employee members, in cases which involve a principle that affects the professional status of the employee members or is at variance with the stated objectives of the member societies.

(*b*) Presentation of testimony pertaining to modifications of existing labor laws which would guarantee to professional employees the right to determine whether or not they want to bargain collectively, and where they desire it to do so through representatives of their own choosing in a bargaining unit of their own choice; with the proviso that the professional engineering societies should do nothing that would tend to deny to professional employees the right to bargain collectively.

C. Procedure

1. Establish a Labor Relations Committee—including the Chairman of Engineers Joint Council as chairman and the secretaries of all societies participating in the work of the Committee on the Economic Status of the Engineer. The Committee shall have a secretary in its employ and without vote. The Chairman of the Committee on the Economic Status of the Engineer and of the Committee on Collective Bargaining by Engineers in Professional Work, and a Labor Relations Consultant selected by the Committee, shall be non-voting members. This Committee shall be charged with administering and effectuating a program under the policies adopted by Engineers Joint Council relating to labor laws and labor legislation.

2. Establish a procedure utilizing the secretaries of the several participating societies for obtaining prompt decision on a specific program by the individual professional engineering societies.

3. Establish advisory committees with appropriate geographical distribution to keep the Labor Relations Committee informed concerning the reactions and attitudes of the society members and general developments in their respective areas on matters relevant to the Committee's work.

4. Establish panels of outstanding engineers who, when needed, would assist the legal counsel in presenting the position of the professional societies before Congress or other agencies of the Government.

5. Retain a Labor Relations Consultant who shall advise the Committee on the Economic Status of the Engineer and its subcommittees, and under the direction of the Labor Relations Committee shall serve as Labor Relations Consultant to one or more of the participating societies.

6. Retain legal counsel who is familiar with labor laws and legislation as an adviser to the Committee on the Economic Status of the Engineer and its subcommittees, and under the direction of the Labor Relations Committee shall serve as Legal Adviser and Representative on Labor Matters to Engineers Joint Council or to one or more of the participating societies.

7. Develop a questionnaire by the Committee on the Economic Status of the Engineer and request the participating societies through that Committee to canvass their individual members to determine their opinions concerning collective bargaining for professional employees.

8. Develop suitable definitions of "professional employee" and "subprofessional employee" which will be available should a demand for such definitions arise either under existing labor laws or when new legislation is under consideration.

Delegates on EJC from ASCE, ASME, AIEE, AIME and AIChE, gave the proposed policy and procedure a thorough going over and took action as quoted below:

VOTED: (1) To receive the report of the Committee on Economic Status of the Engineer (labor policy) with endorsement in principle, and

(2) To refer the report to the constituent societies of EJC for their con-

sideration and report, the report to be made directly to the Committee on Economic Status of the Engineer.

After voting to send the proposed policy statement to its constituent societies, Engineers Joint Council discussed ways and means of accelerating a final decision. EJC has no power of itself to adopt policies or to take other actions to commit any of its constituent societies until the societies agree. Each of the constituent societies of EJC has an "Employment Conditions" committee, or its equivalent. The governing bodies of the EJC societies doubtless will refer the EJC labor-policy statement to their respective appropriate committees.

It is not expected that all five EJC societies will separately agree on the EJC labor-policy statement exactly as presented. To adjust such possible differences, EJC directed the Chairman of its Economic Status Committee to call a general conference—as soon as all of the constituent societies of EJC have separately acted on the labor-policy statement submitted by EJC. The thought is that the EJC committee and the chairman of the appropriate committee of each constituent society and the National Society of Professional Engineers, in conference, will be able to develop a labor policy and procedure in which there would be mutual concurrence when the final document again reaches the governing bodies of the several societies.

The activity here reported affords more concrete evidence, if any were needed, that the principal engineering societies of the nation are working harmoniously together through Engineers Joint Council toward the solution of problems common to all professional engineers.

Kansas Section Seeks Amended Engineers' License Law

Coordinating the activities of several engineering organizations in the State of Kansas, the Kansas Local Section, ASCE, has joined in the formation of the Kansas Engineering Council. The immediate objective of the Council is amending the existing Engineer Registration Law to make licensing of Professional Engineers in Kansas compulsory rather than optional.

The new organization, formed on March 30, is not another engineering society. It has no individual members—rather organizations make up its membership, as represented by authorized officers. In addition to the Kansas Local Section, the Association of County Engineers, the Kansas Engineering Society, and the Kansas Society of Professional Engineers are member groups.

Preparation of the text of the amendment to the existing Engineer Registration Law is now under way by a committee consisting of C. H. Scholer, M. ASCE, George W. Lamb and P. D. Haney, both Assoc. M. ASCE. Murray A. Wilson, M. ASCE, was appointed chairman of the publicity committee for the enactment campaign. It is planned to get pertinent information into the hands of the legislators, pointing out the need for an effective engineering license law.

Past-President Elected a Trustee of CED

Malcolm Pirnie, Past-President of ASCE, has been made a member of the Board of Trustees of the Committee for Economic Development. In accepting this post, he wrote:

"My election to represent the engineering profession on your Board of Trustees is an honor which I accept with its duties and responsibilities. I shall anticipate the opportunity your Board has given me to join in its efforts to solve some of the complex problems confronting the business of our country "

When Mr. Pirnie's name was proposed by the nominating committee, he was unanimously elected to the trusteeship.

The Committee for Economic Development is a private, non-profit organization completely independent of any government or private agency. It is enlisting the aid of both individuals and organizations in a drive to provide for new high levels of productive employment. Its work is financed entirely by contributions from private business.

1946 Edition of Model Registration Law

A 1946 edition of the recommended Model Registration Law for state registration of professional engineers has been approved by eleven national engineering societies. The result of a conference held August 28, 1945, the new edition includes revised definitions of "Professional Engineer" and "Engineering Practice," as reported in the November 1945 issue of Civil Engineering, page 523, and a few other minor changes.

Representatives of twelve engineering societies in the United States participated in the revision, and the Boards of Direction of the following eleven have now formally approved the revised Model Law:

- American Society of Civil Engineers
- American Society of Mechanical Engineers
- American Association of Engineers
- American Institute of Consulting Engineers
- National Society of Professional Engineers
- National Council of State Boards of Engineering Examiners
- American Institute of Electrical Engineers
- American Society of Heating and Ventilating Engineers
- American Institute of Mining and Metallurgical Engineers
- Society of Naval Architects and Marine Engineers
- The Illuminating Engineering Society

As this is being written, the twelfth participating Society has yet to hold its annual meeting, at which approval will be sought.

A representative of the (Canadian) Dominion Council of Professional Engineers was present at the August 1945 conference, and reports that the Council has recommended favorable consideration of the new definitions to the provincial Association of Professional Engineers whenever revisions in their charters are made. The Canadian provincial charters are on a different basis from those in the United States so that Canadian endorsement of this Model Law in its entirety hardly would be expected.

Individuals and organizations requesting advance information on the new edition of the Model Law have been supplied with a mimeographed list which recites, section by section, the differences between the last (1943) printed edition and the forthcoming 1946 edition. Copies of this list, as well as of the 1943 edition of the Model Law, are still available from Society Headquarters.

When copies of the new 1946 edition are received from the printer, they will be distributed promptly to all participating societies and state boards of engineering examiners. Other interested individuals and organizations may obtain copies upon request directed to the headquarters of any participating organization.

New Chairman for Construction Division Committee

R. B. Wiley, Head of the School of Civil Engineering and Engineering Mechanics at Purdue University, has been appointed to the chairmanship of the Committee on Construction Contracts and Specifications. This is a committee of the Construction Division, ASCE.

In this post Professor Wiley follows Frank M. Masters, who resigned from the chairmanship but continues as a member of the committee. Other members of the committee are Robert W. Abbett, Verne L. Peugh, Eugene W. Robinson, and James H. Stone.

Notes from the Capital

Occasional Information Transmitted by the Society's Washington Representative and Believed to Be of Special Interest to Civil Engineers.

International Exchange of Specialists by the State Department

THE DIVISION of International Exchange of Persons, a part of the Department of State, furthers the exchange of scientists, technicians, professors, students, and industrial trainees between the United States and other countries. Included in the exchange have been engineers from other countries who have come to the United States for study, and also United States engineers who have cooperated on engineering projects in other countries.

Among the engineers who have undertaken such assignments are John L. Savage, Hon. M. ASCE, consulting engineer of the Bureau of Reclamation, who has given engineering service in China, India, Afghanistan, and Palestine; Frederick C. Schlemmer and Ross M. Reigel, Members ASCE, of the TVA, who have been engaged on a study in India; and S. S. Steinberg, M. ASCE, of the University of Maryland, who made a survey of engineering schools in South America. At the present time Oren Reed, M. ASCE, also of TVA, is in Brazil making a study of the electrification project at the Paulo Afonso falls.

Twenty-two highway engineers from 16 of the other American Republics are now in this country under the Inter-American Highway Training program for one year's study in highway design, construction, maintenance, and operation as practiced in the United States. This program is being sponsored by the American Road Builders Association, the Department of State, the Office of Inter-American Affairs, the Public Roads Administration, and the Pan American Highway Confederation. Included are a series of lectures on every phase of highway construction; a five weeks' tour through the Middle West to inspect construction, maintenance, manufacturing plants, and highway departments; and practical training for about eight months with state and county highway departments and manufacturing plants throughout the country.

The Division is composed of three branches, one of which, the Organizational Liaison Branch, develops and maintains relationships between the Department and organizations interested in international exchanges of knowledge and skills. Another branch of the Division is concerned with the exchange of students and industrial trainees, including the selection, orientation and training of those coming from abroad to the U.S. for study.

A third branch of the Division is that interested in the exchange of professors and specialists. From regular appropriations it has awarded financial grants for such exchanges with the other American Republics since 1938, and during the past three years has been able to make comparable grants for exchanges with the Near and Far Eastern countries through supplementary sums given from the President's Emergency Fund.

"Mr. Chairman, Ladies and Gentlemen—"

That time-honored salutation of the public speaker often paves the way for a brief period of valued instruction, intellectual stimulation, or entertainment. Too often, however, it is the opening gun in a long and boring engagement, testing the perseverance of the speaker against the endurance of his audience. Enlightened engineers have quite definite opinions on this subject—not all in agreement, it must be said. A firm stand has been taken by the Society's newest Director, Roy W. Crum.

Director Crum stated his position in the form of a public address some time ago, calling his locution "Technical Tedium or Otherwise." This appeared in the Journal of the American Concrete Institute and is reprinted here for whatever guidance it may offer for potential orators.

Technical Tedium or Otherwise

By R.W. CRUM, M. ASCE

DIRECTOR, HIGHWAY RESEARCH BOARD, WASHINGTON, D.C.

AT LAST your time has come; after hours of waiting through the interminable and boring speeches of your fellow conferees the chairman is about to call upon you. He announces your paper; you rise and, accompanied by a scattering of perfunctory applause; walk briskly to the platform, only stumbling on the top step and getting your feet tangled in the wires strewn around the floor for the loud speaker apparatus.

"Mr. Chairman, ladies, and gentlemen," you say, and reach in your inside coat pocket for the paper. Consternations reigns for a moment when you find it isn't there, but you haven't quite lost all of your presence of mind yet and remember that you put it in your left-hand outside coat pocket. Fishing it out you are ready to go ahead after first disburdening yourself of the few ill chosen introductory words that you have been mulling over the last hour and a half.

Your labored joke doesn't get much of a laugh but you are too flustered to bother about that. Grasping your bulky manuscript firmly but shakily in both hands and carefully avoiding the "mike," if there be one, you start to read. After reading one page you are somewhat appalled by the magnitude of the remaining task. You wonder momentarily if you are going to be able to get through in the allotted twenty minutes. But you haven't time to worry about that now and anyway time alone will tell. Gluing your eyes to the page you proceed. About this time some ill-mannered person in the rear of the room calls "louder." Rather resentfully you raise your voice for a few lines but you can't think of that and keep your place at the same time so your voice soon fades down to your usual tone and thenceforward you pay no attention to such unwarranted distractions.

By this time you have recovered some of your self-confidence and most of the shakiness is gone and you are forging ahead full steam. But you don't dare glance at the audience or it will return and you will lose your place. On and on you go without thought of time. By and by you become aware that the chairman is trying to convey some sort of signal to you, but you can't take on his troubles too, and you keep on reading till you realize that you have come to that welcome period when you can show the pictures.

Saying, "I have some lantern slides that I would like to show if there is time." You start a search for the push button that will signal the operator, finding it, after some confusion, grasped firmly in your right hand.

The first slide comes on and turning your back to the audience you rather con-

fidentially tell the screen what the picture is about. This takes some time as it is a complicated table with lots of data. This part of the speech doesn't take over a half hour as there are only about a dozen of the slides crammed with tabulated data and intricate curves. In doing this you repeat practically everything you read before the picture came on.

As the lights return you notice that the chairman is about to have apoplexy and there is a red light shining on the reading desk in front of you, but the whole point will be lost unless you read your conclusions and so you struggle on manfully to the bitter end.

At last there is no more to read. You say "I thank you" and stagger from the platform with the beginning of a mild inner glow that says to you "well done." This feeling is heightened by the applause which is louder this time, indicating that the audience's feeling of relief that you are through is slightly greater than its courtesy in giving you a hand when you started. To tell the truth, no one has listened for the last 45 minutes.

The chairman is now saying, "I am sorry that on account of the fact that we are way behind our schedule it will be necessary to defer the discussion of this interesting paper and proceed to the next item on the program."

You think, resentfully, that if the speakers before you hadn't taken so much time there might have been some interesting discussion of your absorbing topic. But you are too overwhelmed with relief at having the thing done to cherish that feeling long and settle down on the end of your spine to enjoy the next paper in a rather comatose condition.

But instead of being soothed by a gentle flow of monotone as you expect something seems to be happening; your lethargy is being dispelled; the man on the platform is talking in such a way that you are becoming interested in spite of yourself. He is reading from a manuscript but from the way he is holding it you can tell it isn't very long. And he seems to know what he is saying so well that he can look up and actually talk to the audience most of the time.

It doesn't take him very long to tell what the paper is about and why and then he jumps right over the tedious details of what he did, which took so much time in your paper, and goes on to tell what he found out. Soon he comes to a place where some illustration is indicated. Without pausing in his stride he signals the operator and a slide comes on the screen; just a simple little table that anyone can grasp at a glance but full of significance. Glancing over his shoulder to make sure the picture is the right one, the speaker describes it quickly and goes on to the next thought in his paper. Presently he comes to the next slide. This time it is a diagram; just a single curve, but illustrating a telling point forcefully and without loss of time.

Well, time has been getting on and the chairman even in this case signals the speaker that his time is about up. Strangely, this doesn't seem to disconcert him; he just goes for the last sheet of the manuscript, reads it quickly and makes a graceful exit. Too good to be true—for a burst of appreciative applause wakes you up and you realize that at least part of this remarkable performance has been the figment of a dream, but the man has done a good job and got through almost on time. Maybe he took the secretary's letter of instructions seriously.

Musing on this while sticking out the rest of the program you think; "I wish I could present a paper like that" and later, being a person reasonably quick on the intake and still having plenty of self-confidence you say to yourself, says you, "By heck, I can do a job like that." And so being a confirmed convention hound and a man of experience and ideas besides having opportunities to write technical papers, you make yourself over into a forceful and interesting speaker by means of a few simple principles based upon your illuminating flash of insight while drowsing through a dreary session.

1. You realize that most technical papers have to be long enough to cover the subject thoroughly with supporting data to satisfy the studious reader who will ultimately use your material, but you also realize that there is no need to present all this orally and that no one would get it even if you did. No one can get the good out of a technical paper by reading it just once. Many passages must be read and reread and reread and studied, so why should you expect anyone to grasp it all instantly while you read it to him? Better just read him the significant parts that he can assimilate as you go along.

2. It is apparent therefore that the first thing to do is to prepare a condensed version of the paper that can be read in the allotted time. Twenty minutes is about right, although some gifted persons can hold an audience with a dry subject for thirty.

In this version, tell what you did and why you did it and then jump right over the dreary details of how you did it and tell about what you found out that is new and interesting.

3. Having written the condensed version, read it aloud for timing. Then rewrite it so that the time will just be nicely filled. Then rehearse it—to your wife, or secretary, or the mirror until you can deliver it with some degree of animation and direct appeal to the audience. (It sometimes helps to pick out someone who looks as if he agrees with you and aim many of your remarks at him. His nods will spur you on, or else pick out a dumb-looking one and see if you can wake him up.)

4. But let's not forget the slides. If well done they can add greatly to the quick comprehension of a technical talk. Just remember to express only one idea on a slide and make it so simple that about all you need to do is name it. It is best to use the slides to illustrate points as you go along. If left to be shown all together at the end there is a great tendency to waste time repeating what has already been said.

5. Sometimes you do miscalculate and the chairman calls time on you before you are quite through. Why not provide in advance for this contingency and if it arrives, just turn to the closing statement you have already prepared, read it and stop?

6. After you have prepared and delivered a few papers in this way you will probably discover for yourself that there is an even better way. Go ahead and write the short version, then write an outline of it, then memorize the outline and soak yourself in your subject till you don't need a manuscript. Just talk and follow the outline in the back of your head. Of course it is a good idea to have a copy of the outline on small cards in your pocket in case of emergency. You are not likely to need it but if you do, it will save the day. Doing it this way it is also easy to go too long and bring the chairman's warning down on you, so have that prepared closure all ready to grab and read if you haven't had time to memorize it.

7. This is not intended for a discourse on technical writing, but one principle should be mentioned that is of particular importance in preparing a short paper for oral presentation.

Write simply, using short common-usage words and as few of them as possible.

For instance, to say: "When concrete is being placed during cold weather and the air temperatures may be expected to drop below 35 degrees Fahrenheit, a sufficient supply of straw, hay, grass or other suitable blanketing material shall be provided along the line of the work and any time when the air temperature is expected to reach the freezing point during the day or night, the material so provided shall be spread over the pavement to a depth to prevent freezing of the concrete before it has thoroughly hardened," may be perfectly good specification writing, but it you want to make the point in a speech why not say: "During freezing weather freshly laid concrete pavement should be protected by a suitable insulating layer."

On reading this thing over, it doesn't seem so difficult; I don't think one needs to be an expert to follow these rules. I think I will try it myself some day.

Virginia Student Chapter Conference

A CONFERENCE of all Student Chapters in the State of Virginia, sponsored by the Society's Virginia Section, was held at Roanoke on May 28, 1946, for the first time since its suspension during the war years. The Chapters represented were those at Virginia Military Institute and Virginia Polytechnic Institute. The University of Virginia was unable to send representatives because of examination schedules. The Virginia Military Institute brought over 93 students and faculty in Army trucks, and Virginia Polytechnic Institute brought a total of 36.

The two groups met at 9:30 a.m. at the plant of the Virginia Bridge Company, where they were divided into groups and taken on personally conducted tours of all departments. The last time the students toured the plant, Bailey Bridges were on the production line, so the conversion to peacetime work was noted with interest.

The students then "entrucked" and drove into Roanoke to spend the afternoon on several optional trips. Objectives included the Salem filter plant, the Carvins Cove addition to the Roanoke water system, and a trip through the extensive and modern plant of the Stone Printing and Publishing Company.

The Conference dinner was held in the appropriate background of the "Railroad Room" of the Hotel Roanoke. A new wing in process of being added to the hotel gave the students an opportunity to observe the steelwork, which held special interest because it came from the Virginia Bridge Company, visited in the morning.

Colonel R. A. Marr, Jr., president of the Virginia Section and chairman of the ASCE Committee on Student Chapters, acted as chairman of the Conference. It was he who had reorganized the Conference after its wartime suspension He opened the after-dinner program by introducing Prof. P. H. McGauhey, Faculty Adviser of the Chapter at Virginia Polytechnic Institute and Professor of Sanitary Engineering there. He in turn introduced Franklin P. Turner, Principal Assistant Engineer with the Norfolk and Western Railway, who is the Contact Member for V.P.I. He spoke briefly on the Carvins Cove job. Two brief student papers followed, one by a member of the Chapter at Virginia Military Institute and the other by a Chapter member from Virginia Polytechnic Institute.

The feature of the evening was an address by Harrison D. Comins, Assistant to the Secretary of ASCE, in charge of Student Chapter affairs. He outlined what the Society can do and is doing for the student and junior engineer, and commented also on collective bargaining and the registration of engineers.

A committee was appointed to plan for next year's Conference, to consist of Prof. J. H. C. Mann, of Virginia Military Institute; Professor McGauhey, of Virginia Polytechnic Institute; and Prof. Frank W. Wheeler, of the University of Virginia.

Students attending the Conference were extended the facilities of the Roanoke Country Club, and following adjournment many took advantage of this opportunity to entertain their dates.

Engineers Seeking Books for War-Damaged Libraries

THE FIVE national engineering societies, which recently issued an appeal to engineers throughout the United States to contribute engineering books and other technical literature to help restore engineering libraries overseas, have joined forces with the American Book Center for War Devastated Libraries, Inc., with headquarters in the Library of Congress, Washington, D.C. The Book Center will receive, sort, assign, pack, and ship the books. It works closely with the Department of State and is recognized by foreign countries. It enjoys shipping privileges and priorities which facilitate deliveries abroad. UNRRA feels that these programs are so directly related to the reconstruction of devastated countries that it is providing precious shipping space. Some 34 countries receive these books.

The Committee on International Relations, headed by Malcolm Pirnie, M. ASCE, is carrying on the effort for the engineers. It represents the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers, and American Institute of Chemical Engineers.

Shipping facilities are precious and demand that all materials be carefully selected. Emphasis is placed upon publications issued during the past decade, upon scholarly books which are important contributions to their fields, upon periodicals (even incomplete volumes) of significance, upon fiction and non-fiction of distinction. All subjects—history, the social sciences, music, fine arts, literature, and especially the sciences and technologies—are wanted.

It is important also to mention what is not needed. In this class are textbooks, out-dated monographs, recreational reading, books for children and young people, light fiction, materials of purely local interest, popular magazines such as *Time*, *Life*, *National Geographic*, etc., popular non-fiction of little enduring significance. Only carefully selected federal and local documents are needed, and donors are requested to write directly to the Center with regard to specific documents.

Bookplate for Each Volume

Bookplates from an original drawing by G. H. Kuechler will be mailed on request to persons wishing to give books. The bookplate, 4 by $5^1/_2$ in., shows five large volumes bearing the insignia of the five societies, with space for names of recipient and of donor "through the engineers of the United States of America."

Contributors are asked to state their book offer in writing directly to Chairman of Book Commission, Engineers Joint Council, 29 West 39th Street, New York 18, N.Y. This will obtain their supply of bookplates and enable the societies to keep a record of accomplishment. Shipping instructions will be sent them. Gifts of money will be used by the Committee to purchase new books for special needs.

How to Get Technical Information—Engineering Societies Library

THE SCOPE of the services offered by the Engineering Societies Library is such that its large store of information is available to those who cannot visit the Library as well as to those who can; to those who are members of the Founder Societies and to those who are not. This organization, supported by all these societies, is housed in the upper part of the headquarters building.

One of its primary services is in maintaining a free Reading Room, on the 13th floor, where a trained staff is ready to help the reader so that he will not waste his time in aimless searching. The Reading Room opens at 10 a.m. weekdays. Mondays to Fridays it closes at 10 p.m. and Saturdays at 6 p.m., except during the summer when it closes at 5 p.m. every day. It is closed on Sundays and most legal holidays.

Distance and lack of time prevent many from coming to the Library. To serve these persons, a specially trained staff is available to make literature searches, translations, and copies of library material. All services are rendered at cost.

Searches

The Service Bureau handles questions on any engineering subject that can be answered by consulting the existing technical literature. This service ranges from recommending books on a specific subject to the preparation of compre-

hensive annotated bibliographies. Literature searches are made for all purposes, including that of disclosures related to patents.

Searches are undertaken to suit the exact specification of the inquirer. To do this it is necessary to know:

1. The subject, stated as exactly as possible, with indication of those phases to be included and those, if any, to be excluded. Should the subject be covered very thoroughly or will a less complete search suffice?

2. Period of time to be covered.

3. Is the search to cover materials in all languages or only in English? Is it to be restricted to material from any country or countries?

The charge for searching is $2.50 per hour, with a 20% discount to members of the Founder Societies. On request, the cost of covering a given field for a given period will be estimated.

Translations

The rates charged per hundred words for English translations of technical articles of ordinary difficulty are:

German, French, Dutch, Italian, Spanish.........	$1.00*
Russian, Polish, Portugese, Danish, Swedish, etc.....	1.20*
Japanese.................	3.00*

* 20% discount to members.

A small additional charge will be made for the extra time required for articles that contain a high proportion of formulas or other difficult material. The cost of any translation will be estimated if requested, but time can be saved by indicating in your first letter the amount you are willing to pay. If this is sufficient to cover the cost, the work of translating can begin at once. The cost will be the same whether or not an estimate is supplied, as the work is done at cost.

Photostats and Microfilm

Photostatic copies of material in the Library can be supplied for 30 cents a print (25 cents to members). This price is for 11- by 14-in., white on black (negative) prints. Black on white (positive) prints cost an additional 30 cents each (25 cents to members). Reductions or enlargements can be supplied.

Microfilm is economical for copying long articles; photostating is generally preferable for short ones. As most technical articles are short, the Library does not have equipment for microfilm copying, but by arrangement with another organization, the Library can supply microfilm copies of its material. Any one article from a magazine can be supplied for $1.50, regardless of the length of the article.

As all services are rendered at cost, payment in advance is requested when the exact cost of the work is known. Invoices will be sent when payment in advance is impracticable.

Special Services for Members

As the Engineering Societies Library is supported largely through the allotment of a portion of the dues of the members of the Founder Societies, individual members receive special rates on services and they may borrow library books. Minor requests from members are handled without charge. All other services of the Library are also available to members.

Because the Library's material is valuable and much of it in frequent demand, the Library Board has established the following rules governing the loan of books:

1. Books, including bound serial publications, may be borrowed by any member of a Founder Society, if in good standing and residing in the continental United States or Canada. (Applicants are asked to name their society.)

2. A charge of 25 cents a week or fraction of a week will be made for each volume borrowed.

3. The maximum length of time for any loan is two weeks, not counting time in transit.

4. Members may have as many as three volumes on loan at one time.

5. Return postage and insurance must be paid by the borrower.

6. Rare books and reference books are lent only after approval by the Library Board.

Requests should be addressed to the Engineering Societies Library, 29 West 39th St., New York 18, N.Y.

News of Local Sections

Recent Activities

Buffalo Section

The economic coordination of resources in a steam-hydro power system was described by Earl B. Strowger, of the Niagara Hudson System Companies, at the May 15 meeting of the Section. Society Vice-President Arthur W. Harrington was also present and spoke briefly on current Society activities. He mentioned particularly the increasing cost to the Society of combating trade union efforts to bring professional men under their domination.

Central Ohio Section

A talk on modern methods of topographic mapping comprised the technical program at the May 16 meeting of the Central Ohio Section. This was given by T. P. Pendleton, chief topographic engineer for the U.S. Geological Survey, who dealt principally with developments during the recent war period. Revising maps of the home land, parachuting triangulation crews into an African jungle, and mapping (without ground control) enemy-held territory in the Orient were among the varied assignments successfully carried out. Mr. Pendleton showed slides of some of the equipment used and described the results obtained.

Cleveland Section

A comprehensive review of the Spring Meeting of the Society was presented at a recent gathering of the Cleveland Section by Society Director Frank C. Tolles. The Local Section Conference was reported by Alfred D. Yanda, secretary-treasurer of the Section, while the Student Conference was covered by Professors George E. Barnes and G. Brooks Earnest. The scheduled speaker was Oscar Hoffman, associate professor of civil engineering at the Case School of Applied Science, who discussed soil mechanics.

Colorado Section

Two members of the Colorado State College faculty gave the principal talks at the May dinner meeting of the Section. First, Roy M. Green, president of the college, discussed the increased development of rural areas as a result of engineering efforts in the fields of irrigation, machinery, power, communication, and transportation. He was followed by Prof. Dwight F. Gunder, who is in charge of graduate engineering at the college. Professor Gunder described the development of rockets and jet-propelled devices during the war, tracing this development from the "bazooka" to the missiles finally prepared for attack of the Japanese mainland.

Dayton Section

The problems to be overcome in establishing a 1,700-bed military hospital were explained by Robert Gray, who was a captain in the Corps of Engineers and utility officer in charge of a U.S. General Hospital in England during the war, at the May luncheon meeting. Mr. Gray is now assistant to the chief engineer of the Ohio State Highway Department. A brief account of the Local Section Conference at the Spring Meeting concluded the program. This was given by Ralph L. Woolpert, president of the Section.

Florida Section

Members and guests of the Florida Section recently inspected a floating elec-

tric power plant, the *U.S. Inductance*, which is anchored off Jacksonville and helps furnish the city's electric power. A dinner and technical program followed inspection of the plant, which had been arranged by R. B. Cowan, the superintendent. The program supplemented the inspection trip, with George B. Hills giving a talk on the electrical generating and distribution facilities of the city. Mr. Hills is a member of the Jacksonville firm of Reynolds, Smith and Hills, which has recently completed a survey and report on the electrical facilities of the city. He pointed out that while the population of Jacksonville increased from 91,558 in 1920 to 206,000 in 1945, no improvements to the electrical plant were made between 1936 and 1945. Thus the existing demand of 77,500 kw is met by 45,000 kw from the permanent city-owned plant and 32,500 kw furnished by the floating power plant. Even though the cost of power from the *U.S. Inductance* is $1,000 a day, Mr. Hills said, the city profits from its use. Participants in the general discussion that followed were Mr. Cowan and four associates in the firm of Reynolds, Smith and Hills—J. H. Drake, W. L. Garlington, C. F. Titus, and H. McClammy.

Intermountain Section

Utah's highway system was discussed at a recent dinner meeting, held at Ogden. The principal speakers were W. F. Smith, district engineer for the Public Roads Administration, whose subject was "The State Highway System," and Ray McLeese, chief engineer for the Utah State Highway Commission, who described the secondary road system. Much of the May 17 meeting was devoted to business discussion. The technical program for the occasion consisted of an open forum on the water-development program of the state, conducted by E. U. Moser, vice-president of the Section. There were also documentary films furnished by the Navy and the Byers Wrought Iron Pipe Company.

Iowa Section

The Iowa Section reports that its May meeting was a joint session with the Iowa City Engineers Club and the Iowa Engineering Society. The feature of the occasion was a talk on the Keokuk (Iowa) Hydroelectric Plant, which has been functioning for almost thirty-five years. This was given by Paul Mercer, plant manager. A number of Student Chapter members swelled the attendance.

Kansas City Section

The Pick-Sloan plan for the development of the Missouri River basin was discussed by Maj. Gen. Lewis A. Pick, Corps of Engineers, U.S. Army, at the May 15 dinner meeting of the Section. This plan, which will provide complete flood control for the valley, contemplates construction of a number of large reservoirs in the upper reaches of the Missouri and its major tributaries. The list of guests included William E. Kemp, mayor of Kansas City, who spoke on the city's current public works projects and the part the engineering profession will play in completing these projects.

Kansas Section

Two young veterans, now studying in engineering schools, are this year's recipients of the Kansas Section's prizes of Junior membership in the Society, which were presented at the May 24 dinner meeting of the Section. These are William H. Douglas, of the University of Kansas, and Dale Carver, of Kansas State College. The technical program consisted of a talk by Henry C. Beckman, regional engineer for the U.S. Geological Survey at Rolla, Mo., who outlined the functions and discussed the work of the Survey.

Illinois Section

"The Greater Chicago Public Works Program" was described by Lloyd M. Johnson at the May dinner meeting of the Section. Mr. Johnson, who is chairman of the Engineering Board of Review of the City of Chicago, stated that this seven-year program will involve the construction of superhighways, new sewers, additional parks, street resurfacings, and other projects, and will cost $298,560,000. Members of the Western Society of Engineers and of local groups of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers were in attendance.

Lehigh Valley Section

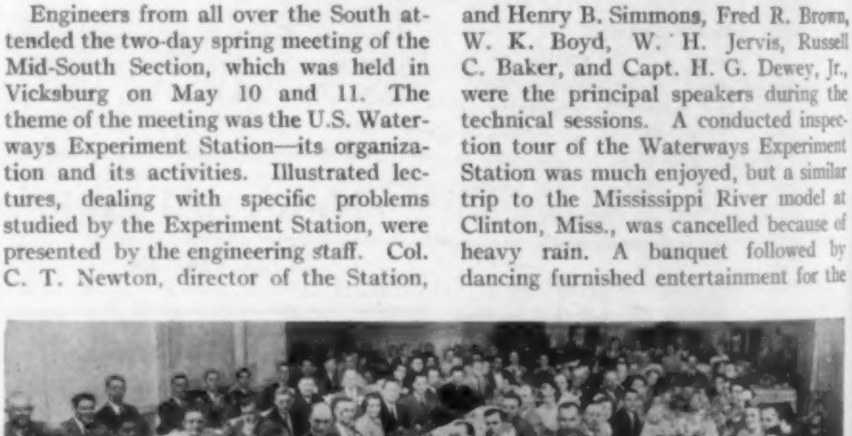
Sound motion pictures on the Golden Gate Bridge, loaned by the Bethlehem Steel Company, were shown at the May meeting. Guest of honor and principal speaker for the occasion was H. T. Critchlow, Society Director from District 4, who outlined the organization of the Society and explained current problems now before the Board.

Maryland Section

The newly elected Society Director from District 6, William R. Glidden, was introduced to the membership at the May dinner meeting. Mr. Glidden gave a brief account of his stewardship, commenting particularly on the work to be done on the two committees of which he is a member. The meeting was then turned over to a "mistress of ceremonies," who introduced the five acts that made up an amusing entertainment program.

Mid-South Section

Engineers from all over the South attended the two-day spring meeting of the Mid-South Section, which was held in Vicksburg on May 10 and 11. The theme of the meeting was the U.S. Waterways Experiment Station—its organization and its activities. Illustrated lectures, dealing with specific problems studied by the Experiment Station, were presented by the engineering staff. Col. C. T. Newton, director of the Station, and Henry B. Simmons, Fred R. Brown, W. K. Boyd, W. H. Jervis, Russell C. Baker, and Capt. H. G. Dewey, Jr., were the principal speakers during the technical sessions. A conducted inspection tour of the Waterways Experiment Station was much enjoyed, but a similar trip to the Mississippi River model at Clinton, Miss., was cancelled because of heavy rain. A banquet followed by dancing furnished entertainment for the



A Banquet Was One of the Enjoyable Features of the Spring Meeting of the Mid-South Section

meeting, and a special program had been arranged for the ladies. The list of guests included Society Director H. F. Thomson, who congratulated the group on a very successful meeting.

Mid-Missouri Section

With Society President W. W. Horner as guest and principal speaker, the Mid-Missouri Section held its May meeting at Rolla. Mr. Horner outlined the organizational setup of the Society and current problems engaging its attention, and reviewed the participation of the Engineers Joint Council in national affairs of an engineering nature. He also discussed the problem of bringing the Juniors of the Society into closer contact with the older members. Following his talk, there was an open forum, in which members of the Missouri School of Mines and Metallurgy took part.

New Mexico Section

Airport construction in the Southwest Pacific was described by T. G. Brown—formerly a lieutenant colonel in the Corps of Engineers and commanding officer of the veteran 839th Engineer Aviation Battalion in the Philippines—at the May meeting of the Section. Numerous business matters were also discussed at the meeting.

Oklahoma Section

Student Chapter members from the University of Oklahoma and Oklahoma Agricultural and Mechanical College were guests of the Section at a recent meeting in Oklahoma City. During the evening the Section's annual awards of Junior membership in the Society were announced, the recipients being Joseph A. Richardson, of the University of Oklahoma, and Walter D. Ford, of the Oklahoma Agricultural and Mechanical College. The principal speaker was Dr. Clark Dunn, vice-director of the Engineering Experiment Station at Oklahoma Agricultural and Mechanical College, who read a paper entitled "An Engineer's Viewpoint of the Industrialization of Oklahoma."

Philadelphia Section

Following an established custom, the May meeting of the Section took the form of a joint session with the Engineers' Club of Trenton. This year the meeting was held in Trenton and was preceded by an inspection of the Trenton plant of the John A. Roebling's Sons Company. Of special interest at the plant was the one-tenth scale model of a new type of suspension bridge with a 600-ft span, which uses cables instead of a stiffening truss. Following the inspection trip and dinner, Charles F. Goodrich, chief engineer of the American Bridge Company, gave a résumé of the history of the structural steel industry and predicted for it a bright future.

Pittsburgh Section

A symposium on the treatment of industrial waste was presented at a recent joint meeting with the Engineers' Society of Western Pennsylvania. Participants were J. Raymund Hoffert, secretary of the Sanitary Water Board and assistant chief engineer of the Pennsylvania Department of Health, who discussed the anti-pollution laws of Pennsylvania; G. A. Rohlich, professor of sanitary engineering at Pennsylvania State College, who outlined the general problem of industrial waste treatment; and R. D. Hoak, Senior Fellow at the Mellon Institute of Industrial Research, who cited a specific problem encountered in the treatment of pickling liquor wastes.

Providence Section

The potential dangers of the atomic bomb and the peacetime possibilities of atomic research were discussed by Prof. Charles H. Smiley, head of the department of astronomy at Brown University, at the May 21 dinner meeting. During the business session the following new officers were elected for the coming year: Charles A. Maguire, president; Edward J. Hollen, vice-president; and Frederick H. Paulson, secretary-treasurer. The guests included Society Director Albert Haertlein, who described some of the work being done by the Board of Direction for the membership. On another occasion in May the Section met with the Rhode Island Society of Professional Engineers to hear Dr. David B. Steinman, New York consultant and author of *The Builders of the Bridge,* give a dramatic presentation of the lives of the Roeblings and the building of Brooklyn Bridge that has been prepared from his book. The presentation was illustrated with slides and a radio transcription.

Rochester Section

Speaking before a recent joint meeting with the Rochester Engineering Society, Col. Herbert D. Vogel described a proposed flood control dam, which is to be built in the gorge of the Genesee River near Mt. Morris, N.Y., to control the flow through the flat plain from Mt. Morris to Lake Ontario. Colonel Vogel is district engineer for the Corps of Engineers, U.S. Army, at Buffalo, N.Y. Another meeting took the form of a field trip aboard the Federal dredge, the *Taylor,* which is being operated by the Buffalo district of the Corps of Engineers, under the supervision of Col. Harland C. Woods. The dredge was completing the job of deepening the mouth of the Genesee River, and the group was able to witness a complete cycle of the dredging. Supper was served aboard the boat.

Sacramento Section

The Speakers Club of the Sacramento Section presented its annual program at one of the May luncheon meetings. Four returned veterans—Harold J. Whitlock, Walter G. Schulz, William Popper, and Milbern H. Davison—gave a "South Seas Symposium." All are members of the Section and of the Speakers Club. Scheduled speakers at the other meetings were Edwin C. Kelton, of the California Division of Beaches and Parks, who spoke on "Beach Erosion and Control"; James E. McCaffrey, who discussed the present status of the Sacramento Municipal Utility District, of which he is chief engineer and general manager; and Leon C. Bibber, of the Carnegie Illinois Steel Company, who explained the elements of welded design.

San Diego Section

A talk on the technical details of the proposed Low Level Highway from San Diego to Imperial Valley constituted the technical program at a recent meeting. This was given by E. E. Wallace, district engineer for the State of California Division of Highways, who illustrated his talk with maps and plans prepared by the Division of Highways. On May 23, members of the Section and their guests heard Fred Pyle, chief engineer for the San Diego Water Development, speak on the technical details of the current water problems and shortage in San Diego County. Mr. Pyle also presented facts and statistics on the new water aqueduct now under construction.

Spokane Section

Much of the May meeting was devoted to business discussion. The guest of honor and principal speaker was George E. Swannack, Jr., former colonel in the Army Air Force, who described the construction of advance airdromes during our offensive in the Southwest Pacific. Of particular interest was his discussion of the use of local materials, and the exclusive employment of air-borne equipment.

Toledo Section

Plans for the location of inter-regional highways through Toledo were discussed at a recent meeting. The principal speakers appearing in the symposium were A. V. Finch, division engineer for the Ohio State Highway Department, and A. S. Forster, of the Toledo firm of Forster, Wernert and Taylor. A report on the Local Section Conference, held in Philadelphia, was given by Secretary-Treasurer Clair A. Shaler.

Tri-City Section

The May meeting took the form of a joint session with District 13 of the Iowa Engineering Society, at Muscatine. Following dinner, Frank Flynt spoke briefly on the aims of the American Society of Civil Engineers, and L. C. Crawford similarly described the Iowa Engineering Society. The speaker of the evening was Prof. Ned L. Ashton, of the University of Iowa, who gave an illustrated lecture on the subject, "Pre-Stretched Reinforcing Makes Concrete Beams Stronger."

Student Chapter Notes

Purdue University

Members of the Purdue University Chapter and the senior class of the school of civil engineering recently held a testimonial dinner for Charles A. Ellis, professor of structural engineering, who is retiring from the university faculty. A certificate of appreciation was presented to Professor Ellis, who has served as chairman of the Structural Division of the Society. During the business meeting that followed the dinner, the following officers were elected for the 1946–1947 academic year: James W. McKenzie, president; Herbert L. Brewer, vice-president; Robert W. Grass, secretary; and Gordon Stepanek, treasurer. Because of the work involved in a large Chapter, it was decided to separate the offices of secretary and treasurer for the first time. It is believed that this procedure will also enable greater student participation in Chapter management. A talk on the design and construction of tunnels—given by Prof. F. L. Servin, of the geology department—comprised the technical program. There were also movies showing the Army Air Corps' use of radar in bombing Japan.

Utah State Agricultural College

The Utah State Agricultural College Chapter reports a highly successful banquet—the first since the outset of the war when the Chapter became inactive. Speakers and guests of honor were E. O. Larsen, director of Region 4 of the U.S. Bureau of Reclamation; Walter E. Jessup, Western representative of the Society; and George D. Clyde, dean of engineering and mechanic arts at the college. Also present were R. G. Harding and O. C. Lockhart, Contact Members for the Chapter. The new officers for the coming year are Sterling Davis, president; Airus Bergstrom, vice-president; Louis Hickman, secretary; and Stanley Van Ormen, treasurer.

Members of the Utah State Agricultural College Student Chapter

University of Illinois

This year the Chapter resumed its pre-war custom of sponsoring a three-day inspection trip. Although participation in the excursion was entirely voluntary, 74 men made the trip. Points of interest visited included the Chicago Filtration Plant, the Chicago Bridge and Iron Company, the Wisconsin Steel Works, the plant of the Universal Atlas Cement Company at Buffington, Ind., the Chicago Airport, and the Chicago Aircraft Assembly Plant at Des Plaines, Ill. On June 7 the Chapter held a joint dinner meeting with the Central Illinois Section. At this time the Section's awards of Junior membership in the Society were presented to Dalton Hoskins, Barbara Crawford, and Donald Swets. Another member of the Chapter, Thomas Wofford, has been similarly honored with the Illinois Section award. The technical program for the occasion consisted of a talk by Walter E. Robey, resident engineer for the Santa Fe Railroad at Chicago, who discussed the assembly work on the Topock Bridge, which the Santa Fe recently constructed.

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UNIVERSITY OF TENNESSEE

STUDENT CHAPTER OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS

For Excellence in the Effective and Meritorious Conduct of Its Affairs

The ability and professional diligence of your Chapter officers, members and faculty advisor, responsible for your success, have been commended by the Society's Committee on Student Chapters, and the Board of Direction has authorized this CERTIFICATE OF COMMENDATION to be issued.

Awarded for the Year
1945

Secretary and Executive Officer — President

One of the Certificates of Commendation Awarded to 20 Student Chapters for Outstanding Progress
The Awards Which Were Made in Philadelphia Were Reported in Civil Engineering for May

ITEMS OF INTEREST

About Engineers and Engineering

Benefits from Concrete-Mixer Standardization

By Charles S. Embrey

Administrative Assistant, the Associated General Contractors of America, Inc.
Washington, D.C.

According to old records, there were at least twenty different sizes of building mixers and ten different sizes of paving mixers being manufactured at the time of the first World War. Today, with effective standardization, there are eight sizes of building mixers and two sizes of pavers being manufactured, and these efficiently serve every practical present-day need. It is interesting to observe that in those earlier days a mixer larger than 28 cu ft was a rarity. Today's standards include machines up to 4 cu yd, and the large machines are by no means a rarity. In years past all building mixers were on steel wheels and they were side discharge. Today's mixers in the smaller sizes are end discharge, mounted on pneumatic tires, and are trailer type for the most part. In 1920 paver sizes ran from 7 cu ft to 28 cu ft, the smaller sizes being on four steel wheels. The 27E is today's smallest paver, and the 34E the most commonly manufactured. Both are, of course, full continuous tread, and in the 34E size we have also the two-compartment drum, which makes possible an increase in production of from 40% to 70%.

That is a quick picture of the concrete mixer and paver over the last quarter century. During almost all that time, concrete-mixer standardization has been in effect.

Seventeen Years of Standardization

Concrete-mixer standardization, in the form of a joint effort by the maker and user, began in 1922 with preliminary conferences between the principal mixer manufacturers and the Associated General Contractors of America, Inc. The first standards officially sponsored by the A.G.C. were published in 1924. The program has been continued since that time without interruption. The Concrete Mixer Standards have undergone seventeen successive revisions, and have just completed their twenty-second year.

Standard construction mixers today are 3½S, 6S, 11S, 16S, 28S, 56S, 84S and 112S, the size number designating the rated capacities in cubic feet of mixed concrete. Standard pavers are 27E, 34E, and 34E two-compartment. All standard construction mixers and paving mixers carry the A.G.C. Standard Rating Plate.

The mixer manufacturers who comprise the Mixer Manufacturers Bureau of the A.G.C. represent approximately 90% of the construction mixer production and 100% of the paver production. They subscribe to the Concrete Mixer Standards and cooperate in their maintenance and their revision from time to time to keep them abreast of progressive practices and requirements.

Mixer and paver standardization benefits the manufacturer, the distributor, the user, and the public. The manufacturer can schedule his production and handle his inventories with a maximum of certainty and a minimum of waste. Engineering talent is devoted largely to designing a better product in the standard sizes in place of designing in haphazard fashion a variety of sizes and models to meet new offerings by other manufacturers. Engineering and production costs are saved which might otherwise have been devoted to many sizes and models not having a ready and sustained sale value.

The distributor's sales and service functions are simplified. He no longer has to cope with the handling and servicing of a continuous stream of untried new sizes and models. His investment in repair parts is more liquid and more stable. Customers' complaints are fewer because the distributor is now furnishing a product geared to the customers' needs and raised to a high degree of quality and performance. It is important to keep in mind also the fact that nothing in the standardization program has ever impeded the engineering development of the concrete mixer or paver or delayed the introduction of new sizes when justified. Compared with the period in the now rather dim past when a person faced a new size or model every time the sun came up, the manufacturers and distributors must find the present situation a very satisfactory one.

To the buyer and user, namely the contractor, the standardization work has been of immense value. Gone are the days when sizes ranged about a cubic foot apart, claims of capacity among manufacturers and distributors were endless and conflicting, and the contractor had to choose a machine with the hope, but with no certain knowledge, that it would efficiently do the work he had in mind. Today's mixers are scientifically sized and rated, and they are guaranteed to produce. The standard sizes are spaced so that one size takes up where the other leaves off, and there are no needless sizes in between. The machines are better designed, better made, and better adapted to the work at hand. There is a bigger dollar's worth of value in them both from an investment standpoint and as a working tool. Concrete-mixer making, distributing, and buying have been shorn of the waste that went along in the past with a lively and unrestrained competition to turn out new sizes and models without enough coordinated knowledge of the actual needs of the construction industry.

The public, that is, those who pay for construction, either private or public, reap the ultimate benefit of the standardization work since the competition inherent in the manufacturer, the distributor, and the contractor eventually forced the savings along. It is a definite contribution to the basic objective of the construction industry, which is to deliver to the public a constantly increasing value per dollar invested in construction.

Editor's Note: This item is taken from a paper prepared by Mr. Embrey for delivery before a meeting of Region 2, Associate Equipment Distributors.

Injunction Against Unregistered Engineers

A Court of Common Pleas of the State of Ohio has granted an injunction, instituted by the Ohio Society of Professional Engineers, against a firm of engineers who were practicing without being legally registered. The decree applies both to the individual defendants and to the corporation. The individual defendants were perpetually enjoined from calling themselves "engineers" and the corporation was perpetually enjoined from permitting unregistered persons to do engineering work. The order and decree of the Court is as follows:

"1. That the defendant, Designers for Industry, Inc., be, and it hereby is, perpetually enjoined from doing any of the following, either directly or indirectly, through itself, its officers, directors, agents, or employees:

"(*a*) Causing or authorizing any officer, director, agent, or employee who is not a registered professional engineer under the Laws of Ohio to practice or offer to practice engineering within the State of Ohio, provided that this decree shall not be deemed to prohibit or enjoin work by unregistered individuals under the supervision of a registered professional engineer.

"(*b*) Adopting, using, or publishing, in connection with or in reference to any officer, director, agent, or employee who is not a registered professional engineer under the Laws of Ohio, any title including the word 'engineer' or words of like import.

"(*c*) Advertising any Registered Professional Engineer employed by or associated with said defendant, Designers for Industry, Inc., in any manner which would constitute misconduct in the practice of professional engineering.

"2. That each of the defendants, . . . , be and he is hereby perpetually enjoined from practicing or offering to practice engineering in the State of Ohio, or using the word 'engineer' or any word of like import in connection with or in reference to himself unless and until he becomes registered by the Ohio State Board of Registration for Professional Engineers and Surveyors."

. . . It was predicted some time ago that the decision of the Illinois Court, declaring the definition of engineering in the old Illi-

nois Act to be "no definition at all," would have little effect on the administration of registration acts in other states. It is significant to note that the definition of engineering in the Ohio Act, which was based on the Model Law, is almost identical with that in the old Illinois Act, which was declared unconstitutional.

[Reprinted from the June 1946 number of "The Registration Bulletin," published by the National Council of State Boards of Engineering Examiners.]

Engineers in Seattle Choose Own Bargaining Group

SEATTLE'S Boeing Aircraft Company engineers designated as their bargaining agent the Seattle Professional Engineering Employees Association (SPEEA) by an overwhelming majority vote on May 8, 1946. This action, as reported in the Association's publication, the *Northwest Professional Engineer*, affects more than a thousand engineering employees, "included in thirteen job classifications from Detail Engineer through Group Engineer and equivalent grades. The election was conducted at the Boeing Seattle plants under the supervision of the Regional Director of the National Labor Relations Board.

"In answer to the ballot question, 'Do you desire to be represented for collective bargaining purposes by Seattle Professional Engineering Employees Association?' some 720 (or 70%) of the 1,023 eligible employees voted 'yes,' 171 (or 17%) replied 'no,' and 132 (or 13%) did not exercise their right to vote. Looking at the figures in another way, 81% of the employees who cast their ballots voted in favor of SPEEA, against 19% who were opposed. This large favorable vote indicates an active interest and confidence in SPEEA on the part of the engineers concerned, and opens the way for legal negotiations to establish a contract between SPEEA and the Boeing Company.

"The bargaining unit defined in this consent election was the result of a compromise agreement between Boeing and SPEEA representatives. The eligible voters comprised those employees holding the following specific job titles: Detail Engineer, Engineer, Major Engineer, Lead Engineer, Assistant Group Engineer, Group Engineer; Group Service Engineer, Weight Controller-C, Weight Controller-B, Senior Aerodynamicist, Assistant Engineer-Research, Associate Engineer-Research, and Engineer-Research.

"At the SPEEA meeting on April 17, the SPEEA membership voted to accept a bargaining unit excluding Senior Group Engineers at this time in order to permit reaching an agreement with the Boeing management and expediting the holding of the election. However, this provided that Group Engineers would be included.

"The arrangement providing that the present bargaining unit would not include Group Engineers holding supervisory jobs was approved by the SPEEA Executive Committee after the membership meeting of April 17th.

"As the next step in the Boeing negotiations, SPEEA will present to the Company an actual contract based upon the recommendations of our Job Evaluation and Contracts Committees. Any final contract will be presented to the SPEEA membership for its approval before being officially submitted to Boeing by the Executive Committee."

Electric Service Map of California

JUST published by the California Railroad Commission is a 13-color map showing electric service areas in California as of May 1, 1945. The map was prepared by the Commission's staff with the cooperation of the electric utilities and other agencies furnishing electric service to the public. The service area of each major utility is shown by a separate color, while the smaller privately owned utilities, municipal utilities, and other publicly owned utilities are identified by color and name.

The map is 25 by 29 in. overall and has a scale of 25 miles per inch. Copies are available at $1.25 plus sales tax. Requests should be addressed to the Railroad Commission of the State of California, State Building, San Francisco 2, Calif.

Engineering Guild of Oregon

THE association of professional engineers in Portland, Ore., has recently changed its name to the Engineering Guild of Oregon. This group now has 171 members and is expanding this number. Among the employers with which contracts have recently been signed is Timber Structures, Inc.

N. G. Neare's Column

Conducted by

R. ROBINSON ROWE, M. ASCE

"THE SAVANTS of the Engineers Club will be intrigued, I know," said Professor Neare, "to hear that I have made an exhaustive study of the origin of the classical ladder problem. The basic situation developed when the two ladders shipped by Noah to descend from Ararat were crossed during the voyage. One of the Sphinxes measured the ladders and the ordinate of their intersection and asked how far their bases were apart. Cleopatra gave up, as usual, and while Euclid was adjusting his slide-rule, Alexander spoiled the problem by measuring the answer with a Gordian tape. Some say that Pythagorus solved the *pons asinorum* as a step toward the more difficult *scalae asinorum*. As shown in the figure of 6 lines, we are given 3 and asked to find a fourth.

General formulas:

$$a^2 - b^2 = p^2 - q^2 = \frac{32ef^2}{(1-4e^2)^2}$$

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$$

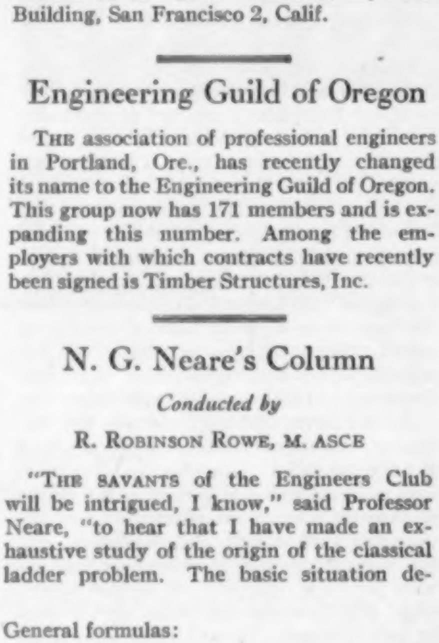

FIG. 1. SCALAE ASINORUM

"Since we must do this in the simplest way, we'll skip Joe Kerr, who would tell you that he had to solve a biquartic in w^2 in which one coefficient was about 80 quadrillion. Also we'll skip Ken Bridgewater, who set up a much simpler quartic:

$$9p^4 - 135p^3 - 2{,}744p^2 + 41{,}160p - 154{,}350 = 0$$

and found two real solutions, 21 and −18.25228, and from the first, $w = 28$. Cal Klater will show us how to avoid big numbers."

"I will," said Cal, "with the reservation that Ken's method is the best for the general setup, because mine is simple only when the answer is an integer. The figure of 6 lines contains 12 line segments. Any of the unknown 9 may be chosen as the principal variable, but we always get a quartic or biquartic. Ken has chosen the simplest. But we can get a simpler one if we let e be the eccentricity of the figure.

"On your figure I have added expressions for p, q and the base segments in terms of the eccentricity, whence the first general formula reduces to:

$$\frac{1-4e^2}{\sqrt{e}} = \frac{4\sqrt{2f}}{\sqrt{a^2-b^2}} \quad \ldots \quad (1)$$

"Substituting the values given for a, b and f, this reduces to

$$\frac{1-4e^2}{\sqrt{e}} = \frac{45}{7\sqrt{7}}$$

and suggests the further substitution $7e = y^2$, giving

$$49 - 4y^4 = \pm 45y \quad \ldots \quad (2)$$

Obviously $y = 1$, whence $e = 1/7$, $p = 21$, and $w = 28$."

"Great," conceded the Professor, "Cleo herself could have seen that y is 1 if one is wise. Otherwise, (2) permits ready solution by cut and try or Horner's method.

"Our new problem concerns three kids, Tippy Towe, Flat Foote and a gal named Toots, standing in front of a mirror hung on the wall. Their H-eyes are, respectively, 6, 5 and 4.5 ft. Tippy, who is 17 ft from the mirror, can just see Flat's feet. Flat, who is 14 ft from the mirror, can just see Tippy's toes. And if Toots can just see her own tootsies, where is Toots?"

[Cal Klater is Richard Jenney. Ken Bridgewaters were Thomas E. Bruder, Anne Othernut (J. Charles Rathbun), Al G. Bray (Allen H. Brownfield), William F. Sloes, John H. Bliss and Wm. Neville Collier with 6 other ways of avoiding quadrillions.]

Can Engineering Survive Being Classed as "Overhead?"

By F. N. Hveem, Assoc. M. ASCE

Staff Materials and Research Engineer, Division of Highways, State of California, Sacramento, Calif.

Engineers may not consider themselves God's noblest effort to date, although most of them, if pressed, will readily admit that the profession probably embraces the best types and the highest caliber of men extant. In spite of a consciousness of virtue, many engineers also feel that their contribution to the community is not always recognized or as highly appreciated as is just and proper. This feeling gives rise now and then to such manifestations as the Speaker's Club of the Sacramento Section of the American Society of Civil Engineers. Here the founding members have expressed their desire to learn how to stand up on what they invariably refer to as their "hind legs," and talk. At least by implication, they wish to acquire a platform presence and speaking technique which will enable them to say something or other calculated to impress the public with the hidden virtues and worth of engineers. Humble "S.I's" often express envy of their more articulate brethren in the legal and medical fraternities.

All this is cited as evidence that engineers are aware of something lacking in their public relations and they are groping toward a remedy. They wonder if the ability to talk and to weave an artful pattern of words will permit them better to sell their wares to the ultimate consumer. After profound study and analysis of the situation it is suggested that the real cause for this dissatisfaction, the organism responsible for this defensive attitude on the part of engineers, is to be found in another quarter. Fellow engineers, I direct your attention to the theory and practice of bookkeeping. I must first hasten to state that I have no wish to cast aspersions on the noble profession of accounting. Doubtless an inscrutable power had some worthy purpose in mind when the first bookkeeper was created; therefore I bespeak a tolerant attitude. After all, they too have to live—I suppose! Among other peculiarities it seems that for some reason all accountants cherish a secret ambition to join the F.B.I. and would rather look for some skulduggery than work as simple recorders of facts and figures. However, one might not object to this sleuthing complex were it not for the fact that as he plies his trade, placing neat figures in this column and in that, the pen-wielder in effect paints a picture with red ink or black wherein the engineer too often appears in a dubious or unfavorable light.

So long as engineers fail to challenge the soundness of the premises on which engineering costs are accounted, they are submitting to being handicapped in their profession. The danger stems from accounting practice wherein engineering costs are reported as an item of overhead. This evil thing arises not as a result of malice aforethought on the part of the bookkeeper—he knows not what he doeth in this regard—but the process becomes evident if we look to semantics, the meaning and effect of words. It would make little difference how engineering activities are classified if it were not for the fact that words have come to have either a "good sound" or a "bad sound" in the mind of the layman.

As most of us work for "John Citizen" in one capacity or another, it behooves the engineer for his own welfare to see that expenditures for engineering are not tabbed with the wrong kind of label. Accountancy has been classified as a profession but to the jaundiced observer it might appear better designated if called a collection of habits, and most of these habits were acquired in the field of business, or more strictly from recording activities in "buying and selling for profit." An oversimplified explanation for the failure of many business firms has been the statement that the "overhead was too high." Thus the average citizen, and perhaps his parliamentary representative (who knows even less about balance sheets than does the average engineer), tends to feel that "overhead" is something which there should be little of.

This habit of so classifying engineering expense is responsible for many absurd conclusions and actions, often working to the disadvantage of the public. Any engineer knows that it is a simple matter to keep engineering costs at a low relative figure; all he has to do is recommend very expensive designs, apply large and extravagant safety factors and devote as little time as possible to thorough study and preliminary investigation. In the bookkeeping columns the figures will appear to his credit. The "overhead" will be low.

There can be only one sound basis for judging the value of engineering preparation, control, and design; that is, by comparing the total cost of the project (including the engineering) with the cost of similar projects. If the engineer should spend 90% of the money in planning and supervision and only 10% in what is called actual construction, and if the total cost of the project were reasonable, no criticism would be in order. It is not necessary to labor this point for engineers; it may, however, be interesting to cite an example of the absurdity which may result from failure to realize which particular cost figures are significant.

A railroad repair shop, operating under reduced conditions, had a normal ratio of two helpers to one machinist. Helpers received $3 per day, machinists were paid $8. With the approach of winter and in expectation of increased repair work, two additional machinists were hired and at the same time four helpers were added. As the assistant foreman had found it impossible to keep the helpers properly occupied, he inquired from the master mechanic why more were hired when they already had a surplus. The master mechanic replied that this was done to keep the average wage scale down, and went on to explain that the railroad was owned and operated not by railroad men but by financiers in Wall Street who knew nothing of railroading and were interested only in profits. The financiers had ordered that the average wage scale should not be higher than $5 per day; therefore, to keep out of trouble, whenever a man was hired at a scale of $8 per day it was then necessary to hire at least two men at $3 per day whether they were needed or not!

The accountant is doubtless a fine chap and perhaps kind to old women and children but his pernicious activities, when misdirected or misinterpreted, constitute a grave threat to the economic security of the engineer and to the legitimate practice of his profession. It cannot be assumed that the systems of accounting are free from absurdities.

It is expensive practice for engineers to operate under conditions which provide an incentive to use snap judgment or to select materials and types of construction without thorough study and investigation. The engineer is not more than human and will inevitably lose some enthusiasm for seeking cheaper types of construction—designs better adapted to peculiar local conditions and in trying to fulfil his purpose in life if he knows that his salary or fees will look worse when viewed as cost percentage of an economical project than they will in comparison with an expensive one.

There seems to be no escape from the conclusion that the engineer must interest himself in the methods and interpretation of accounts, as he has a definite interest and responsibility in seeing that the figures are not misleading or misinterpreted.

The history of living things on the earth has been a history of change, and the survival of the fittest has often meant the survival of the most adaptable and the most alert. Many noble creatures, in fact whole tribes of impressive individuals, have been laid low and their kind have disappeared from the scene through the activities of some small, insignificant organism which kept busily boring in. Probably the termite is as surprised as anyone when a building collapses as a result of his activities, and doubtless he did not "plan it that way," but the termites can get you if you don't watch out.

Civil Service Classification of Engineers Revised

Class specifications for professional engineering positions have recently been revised by the U.S. Civil Service Commission. Outstanding accomplishment of the new criteria, which have become a part of all U.S. civil service classification books, is the clarification of educational requirements for appointment to federal civil service positions.

The more detailed statement thus presented clearly differentiates between "professional," "subprofessional," and "positions associated with engineering." In the "professional" bracket, the specification cites duties requiring "(1) the practical application of basic scientific principles, particularly those of higher mathematics, physics, and chemistry; (2) an intimate knowledge of the fundamental engineering

concepts and terminology, all the units of measurements, and their interrelationship common to all branches of engineering; (3) a thorough understanding of engineering techniques as can be gained through 4 years of engineering training in a recognized college or university, or training equivalent in type, scope, and thoroughness."

Included as typical examples of "sub-professional" positions are draftsmen, detailers, instrumentmen, engineering aids and inspectors. Still further definition is given to "positions associated with engineering but which are neither professional nor subprofessional." Such positions according to the criteria "do not require an understanding of the physical, mathematical and specialized engineering sciences fundamental to professional engineering." Examples given of this last category are construction foremen, expediters, purchasing agents, and accountants on engineering projects.

N.Y. State P.E. Examinations

A CHANGE in the passing grades for Professional Engineer examinations, recommended by the New York State Board of Professional Engineer Examiners, has been approved by the State Board of Regents. In the past, a candidate has been required to obtain a grade of 75% in each examination paper. In the future, an average of 75% will be required, with no grade less than 65% and only one paper with a grade of less than 75%. This change also applies to the Preliminary Examinations for Engineers-in-Training.

Consulting Firm Signs Contract with Professional Engineers Group

PARKER AND HILL, consulting engineering firm of Seattle, Wash., recently signed a contract "recognizing SPEEA [Seattle Professional Engineering Employees Association] as the 'sole collective bargaining agency for all professional engineering employees employed by the company in the State of Washington,' and granting these employees immediate benefits including increased sick leave and vacation privilege plus a 25% raise in salary. The phrase, 'professional engineering employees' includes those in architecture and other arts or professions closely related to engineering.

"This is the first SPEEA contract to be signed. In speaking for the Engineers at Parker and Hill, Lee Sphar stated: 'We have definitely proved that Engineers can bargain effectively through their own Association and procure liberal wage increases without National Labor Union affiliation.'"

This action was reported in the May issue of the *Northwest Professional Engineer*, published by the SPEEA. In the policy statement of the Association it is emphasized that "Membership in this association shall be voluntary," and "It is the policy of this association to bargain for overall job evaluation on a just and equitable basis. Each employee shall bargain individually with the employer to determine his position or salary bracket in that overall plan. His position shall be established on the basis of ability and merit."

Book on Wartime Role of Steel Available

IN A handsomely illustrated new book entitled *Steel in the War*, the United States Steel Corporation describes its war role as the largest producer of America's basic industry. The story of the conversion of this great industry to war production and its expansion to meet the greatest demand for steel ever known is impressive. The 164-page volume recounts the obstacles overcome by the industry's engineers, without whom we would have been unable to build the ships to carry the war to the enemy, or produce the weapons which defeated him. *Steel in the War* also traces the development of many new steels and new uses of steel, which are now available for postwar needs.

The volume should be of permanent value as an industrial reference book. It has been made available to libraries all over the country, where it may be consulted.

New in Education~

Graduate Fellowships at the Experimental Towing Tank

SEVERAL fellowships for graduates of engineering colleges have been established by the Experimental Towing Tank, Stevens Institute of Technology, for men interested in learning the techniques of model tests of ship and flying-boat hulls, as well as in acquiring experience in the broader principles of hydrodynamic research in which the Tank is engaged.

Each fellowship will be for one year, and may in special instances be extended an additional year. The value will be graded in consideration of the educational background and experience of the Fellow in the field of hydrodynamics. Fellows with a bachelor of science degree or its equivalent, but without experience, will receive \$150 monthly, with increases up to a maximum of \$250 monthly for Fellows with one or more years of graduate study, experience in hydronamics, or both.

While no regular graduate school courses are a requisite part of the fellowship, opportunity will be provided, when practicable, for enrollment in such courses at Stevens Institute of Technology or some neighboring school. Opportunity can also be provided for a Fellow to prepare, from his work at the Tank, either a master's thesis or a doctor's dissertation, subject to arrangements made in advance with the institution granting the degree. On completion of each fellowship, a certificate describing the work performed will be issued. Furthermore, the Tank will assist the Fellow in finding employment in the field of hydrodynamics he chooses.

A description of the facilities and a résumé of the work done are published in the illustrated Tenth Anniversary Report of the Experimental Towing Tank, a copy of which will be sent on request. Applicants should submit a letter describing educational background, giving in detail the courses in hydrodynamics or related subjects and professional experience. Applications should be sent to Prof. John P. Fife, Director of Personnel, Experimental Towing Tank, Stevens Institute of Technology, Hoboken, N.J.

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University of Michigan Acquires Airport for Field Test Center

AN educational research program in all phases of aircraft, aviation, and airport operation is about to be inaugurated at the University of Michigan, which has purchased the Willow Run Airport. There laboratories will soon be built, including a supersonic tunnel large enough to obtain data on aircraft flying 3,000 miles an hour or faster.

In discussing this great research center, Dean Ivan C. Crawford of the University's College of Engineering, said that ultimately "almost every department of engineering at the University will be tied in some way with the research and instructional work at the airport."

NEWS OF ENGINEERS

Personal Items About Society Members

EMIL A. VERPILLOT, captain, Civil Engineer Corps, U.S. Naval Reserve, has been appointed deputy expediter in charge of the Office of Production and Supply of the National Housing Agency, in which capacity he will direct the production end of the Veterans Emergency Housing Program. For his wartime service as deputy director of the Alaska division of the Bureau of Yards and Docks, Captain Verpillot recently received a citation from the Secretary of the Navy and the Commendation Ribbon.

C. L. DALZELL is now connected with A. J. Bendler in the consulting engineering partnership of Bendler and Dalzell, with offices at 233 Broadway, New York 7, N.Y. The new firm will specialize in process engineering and structural design. Mr. Dalzell was formerly an engineer for the Procter and Gamble Manufacturing Company.

J. B. CONVERSE, consulting engineer of Mobile, Ala., has been elected a director of the Chamber of Commerce of the United States.

DENNIS K. CULP, lieutenant commander, Civil Engineer Corps, U.S. Navy, is now on permanent duty with the Bureau of Yards and Docks in Washington, D.C., after returning from overseas service with the Seabees in the Southwest Pacific, the Philippines, and China.

THEODOR VON KARMAN, director of the Guggenheim Aeronautics Laboratory at the California Institute of Technology, has been awarded the honor of foreign membership in the British Royal Society. Out of a total foreign membership of 47 in this

ancient society, there are only 15 citizens of the United States.

Carter Jenkins has resigned as director of the Springfield (Ill.) District of the Office of Price Administration in order to establish an engineering practice with Charles H. Merchant and Richard M. Nankivil in Springfield. The new firm—to be known as Jenkins, Merchant, and Nankivil—will work in the field of general engineering, municipal improvements, airports, and recreational and water structures, and as representatives before state and federal construction agencies.

Clayton O. Dohrenwend, formerly chairman of the engineering mechanics departments at the Illinois Institute of Technology and the Armour Research Foundation, has been appointed research consultant and senior scientist of the newly established Engineering Mechanics Section of the Midwest Research Institute at Kansas City, Mo. In addition to offering a research service to industry, the Institute serves as a regional laboratory to promote the resources of the Midwest.

Harold S. Ellington, of the Detroit (Mich.) firm of Harley, Ellington, and Day, Inc., was awarded honorary membership in Tau Beta Pi at the recent annual meeting of the Detroit chapter. Mr. Ellington is one of the first members in the history of the Michigan chapter of the organization to have been accepted on the basis of contribution to the engineering field rather than for purely scholastic standing.

Avron L. Davies has been released from active duty as a lieutenant commander in the Civil Engineer Corps of the U.S. Naval Reserve, and has returned to his former positions with the Michigan State Highway Department and the University of Michigan.

Gerald W. Long, who was recently separated from the Corps of Engineers, U.S. Army, with the rank of major, has been appointed construction and maintenance engineer for Forsyth County, North Carolina, with headquarters at Winston-Salem.

Charles B. Burdick, Chicago consultant, has been elected to honorary membership in the Western Society of Engineers for "outstanding services to the engineering profession." Mr. Burdick is a former Director and Vice-President of the American Society of Civil Engineers.

Fred J. Klaus is now acting city manager of Sacramento, Calif. Until lately he was city engineer.

Lloyd F. Rader has resumed his position as professor of civil engineering at the University of Wisconsin, following his release from the Civil Engineer Corps of the U.S. Naval Reserve. He was a commander at the time of his separation from the service.

Cuthbert P. Conrad, formerly a commodore in the Civil Engineer Corps of the U.S. Naval Reserve, is now president of the Iowa, Illinois Gas and Electric Company at Rock Island, Ill.

G. Brooks Earnest, professor of civil engineering at the Case School of Applied Science, has been elected president of the Cleveland Technical Societies Council.

Ben Moreell has been promoted from the rank of vice-admiral in the Civil Engineer Corps of the U.S. Navy to that of admiral. At present Admiral Moreell is chief of the Navy's Material Division and is operating the soft coal mines, seized under government orders. Admiral Moreell is an Honorary Member of the Society.

J. G. Rollins, until lately director of public works for Dallas, Tex., has accepted the position of city manager of Tyler, Tex. He will be succeeded at Dallas by J. C. Bisset, former assistant city manager.

Bernard F. Hatch has resumed his partnership in the Columbus (Ohio) civil and sanitary engineering firm of Burgess and Niple after serving as a colonel in the Corps of Engineers, U.S. Army.

Charles E. Cutts is now an instructor in the mathematics and mechanics department at the University of Minnesota.

Benjamin K. Hough, Jr., was recently appointed assistant to the dean of engineering at Cornell University. Prior to entering the Corps of Engineers, U.S. Army, in 1942, Mr. Hough had taught at Cornell. At the time of his release from the service he had the rank of lieutenant colonel.

Milton O. Schmidt, until lately a lieutenant in the U.S. Naval Reserve serving as a hydrographic survey officer, has accepted the position of assistant professor of civil engineering at the University of Illinois.

Carl G. Paulsen has been appointed chief hydraulic engineer of the U.S. Geological Survey, succeeding the late Glenn L. Parker. Mr. Paulsen has been connected with the Survey since 1913—most recently in the capacity of assistant chief hydraulic engineer.

Warren H. Sleeger has severed his connection as assistant engineer of the Minneapolis–St. Paul Sanitary District in order to accept a position as civil engineer with the Technical Section of the Veterans Administration.

John Rippstein, previously administrative assistant in the ESMWT program at Cornell University, has accepted the position of assistant engineer in the N.Y. State Department of Public Works. He has been assigned to the Buffalo district, which includes Erie, Niagara, Cattaraugus, and Chautauqua counties.

Gordon H. Butler, Sr., has resumed the presidency of the Polaris Concrete Products Company in Duluth, Minn., after serving overseas as a colonel in the Corps of Engineers, U.S. Army.

Thomas J. Hewitt, division engineer in the U.S. Engineer Office at Wilmington, N.C., is a recent recipient of the War Department's Exceptional Service Award for his wartime service in directing the construction of various military structures in North Carolina.

Gordon M. Fair has been appointed dean of the Graduate School of Engineering at Harvard University, succeeding Dean Harald M. Westergaard who is retiring on June 30. Professor Fair has been a member of the Harvard faculty since 1918—most recently in the capacity of professor of sanitary engineering. Dean Westergaard has been at Harvard since 1936, and dean of the Graduate School of Engineering since 1937.

Francis W. Herring, until lately a commander in the Civil Engineer Corps of the U.S. Naval Reserve, has been appointed director of the land and public services branch of the National Housing Agency. While in the Navy he has been serving as head of the Historical Division of the Bureau of Yards and Docks. He will be assisted by Arthur E. Gorman, who has been appointed director of the public services division of the branch. Mr. Gorman was formerly director of the water division of the Office of War Utilities.

Daniel B. Ventres has been released from active duty in the Civil Engineer Corps of the U.S. Naval Reserve, in which he had the rank of captain, and will resume his duties with the Department of the Interior in Washington, D.C.

Carl A. Trexel, rear admiral, Civil Engineer Corps, U.S. Naval Reserve, is now director of the Alaska Division.

Robert J. Newell, regional director for the U.S. Bureau of Reclamation at Boise, Idaho, has been appointed to represent the Department of the Interior on the recently organized Columbia Basin Inter-Agency Committee.

Richard G. Thomas has resumed his connection with the division of sanitary engineering of the Illinois Department of Public Health at Springfield, after serving as a captain in the Sanitary Corps of the U. S. Army.

Arthur H. Benedict is establishing a consulting engineering practice in Los Angeles, Calif. He was previously district engineer for the Asphalt Institute in Los Angeles.

Edward L. Moreland has resigned as dean of the School of Engineering at the Massachusetts Institute of Technology so that he may return to the Boston consulting firm of Jackson and Moreland, from which he has been on leave during the war years. Dean Moreland will continue at the Institute as executive vice-president, and in this part-time capacity will act as consultant on matters affecting the Institute's relations with the government.

Donald McMurray is now district construction engineer for the Washington State Highway Department at Olympia, this position representing a promotion from that of resident engineer at Port Angeles.

George J. Ray recently retired as vice-president of the Delaware, Lackawanna and Western Railroad after forty-three years of service. He was chief engineer from 1909 to 1934, and vice-president from the latter year on.

Emil H. Praeger has retired as head of the civil engineering department at Rensselaer Polytechnic Institute but will continue to teach on a part-time basis. This arrangement has been made to enable Mr. Praeger to devote more time to his practice in the New York consulting firm of Madigan–Hyland, of which he is a member. Mr. Praeger was recently released from the Civil Engineer Corps of the U. S. Navy, with the rank of captain.

Guy E. Griffin is now chief engineer for the Institute of Inter-American Affairs in Honduras. He has just been separated from the service after over four years in the Corps of Engineers, U.S. Army.

DECEASED

Reid Stanley Aaron (Jun. '40) lieutenant, Air Corps, U.S. Army, was killed by enemy action in the western Pacific on December 16, 1944. Lieutenant Aaron, who was 25, graduated from Virginia Military Institute in 1940. He then became connected with the Norfolk and Western Railway, with headquarters in Portsmouth, Ohio. In 1942 he entered the Air Corps, with the rank of second lieutenant. His home was in Martinsville, Va.

Lewis Warrington Baldwin (M. '16) president of the Missouri Pacific Railroad, St. Louis, Mo., died at his home in that city on May 14, 1946. Mr. Baldwin, who was 71, spent his entire career in railroad work. From 1896 to 1923 he was with the Illinois Central Railroad, attaining the position of vice-president; and from 1923 on he was president of the Missouri Pacific. Twice he had served the government in official capacities. During the first World War, when the railroads were under federal control, he was selected as one of the regional directors, and during the recent war he was commissioned a colonel in the U.S. Army and placed in charge of railway operations in the Southwestern region.

Donald Raymond Brown (Jun. '39) lieutenant (jg), U.S. Naval Reserve, was reported missing in action on November 30, 1943, while serving on the submarine *Wahoo*, and was declared officially deceased as of January 17, 1946. Lieutenant Brown was 28, and an alumnus of Oregon State College, class of 1939. Before entering the service in 1942, he was deputy county surveyor of Sonoma County, California, and his home was at Healdsburg, Calif. Lieutenant Brown was the holder of several decorations, including the Silver Star Medal and Presidential Citation.

William Franklin Dennis (M. '88) retired civil engineer of Washington, D.C., died there on May 2, 1946, at the age of 85. Mr. Dennis was for many years president of the Rinehart and Dennis Company, general railway contractors of Charlottesville, Va., and Washington, D.C., and at one time he also maintained a consulting practice in Washington, retiring in 1924. Earlier he had been assistant superintendent of the Panama Railroad and had worked on the construction of the Catskill Aqueduct and the Chicago Drainage Canal.

Gwynne Wallace Ellis (Assoc. M. '13) contractor of North Hollywood, Calif., died recently at the age of 63. Early in his career Mr. Ellis was city engineer of Pratt, Kans., and supervised the construction of sanitary sewer systems for various towns and municipalities in Kansas and Oklahoma. He then maintained a consulting practice in Pratt, and of more recent years was a grading and paving contractor in Los Angeles.

Donald Egbert Fuellhart (M. '44) civil and petroleum engineer for the New York engineering and geological firm of Brokaw, Dixon and McKee at Natchitoches, La., died on October 23, 1945. Mr. Fuellhart, who was 46, was with Brokaw, Dixon and McKee from 1927 to 1935 and again from 1940 until his death. During this period he assisted in establishing an office for his firm in Shreveport, La., and was in charge of many of the firm's projects in Louisiana. His other experience included assignments with the Louisiana State Highway Commission, the U.S. Department of Agriculture at Baton Rouge, and as civil and petroleum engineer for the Louisiana State Department of Conservation.

Abram Nute George (Assoc. M. '20) district construction engineer for the California State Division of Highways, Los Angeles, Calif., died in that city on May 6, 1946. He was 56. From 1912 to 1917 and from 1919 until his death Mr. George was with the California State Division of Highways—since 1933 in the capacity of district construction engineer. During the first World War he served as a lieutenant in the U.S. Air Service.

John Greer (Assoc. M. '24) designer in the Department of Structures of the Erie Railroad, Cleveland, Ohio, died in Cleveland Heights on May 23, 1946, at the age of 61. Born and educated in Ireland, Mr. Greer emigrated to Canada in 1911. During the first World War he served overseas with the Canadian Engineers, and later was with the Grand Trunk Railroad at Montreal, Canada. He then entered the United States, and from 1921 to 1926 was with the Maine Central Railroad. From 1926 to 1929 he served in various engineering capacities in the United States, including that of superintendent of construction for Allen N. Spooner and Sons, Inc. In 1929 he joined the Bridge Department of the Erie Railroad Company in New York City.

George Edwin Hamlin (M. '23) retired engineer of West Hartford, Conn., died in a hospital in Hartford, Conn., on June 4, 1946. His age was 71. Mr. Hamlin was in the U.S. Engineer Department from 1902 to 1909, when he resigned to join the Connecticut State Highway Department. For a number of years he was superintendent of repairs for the Department, and from 1936 to 1939 he was Deputy State Highway Commissioner, retiring in the latter year because of poor health. Mr. Hamlin was a former president of the Connecticut Society of Civil Engineers.

Derwent Gordon Heslop (M. '20) senior surveyor and draftsman for the Great Western Railway, London, England, died on January 28, 1944, though the Society has just heard of his passing. Mr. Heslop, who was 66, was with the Corps of Royal Engineers of the British Army during the first World War and for several years afterwards. He had been on railway location and construction assignments in India, China, South America, Africa, and Palestine. More recently he was with the Public Works Department of Morogoro, East Africa, and Jacks International Bureau in London, and from 1938 on he was with the Great Western Railway.

Louis Emile Laurent (M. '40) of Cleveland, Ohio, died on November 5, 1945, at the age of 71. From 1900 to 1909 Mr. Laurent was with the Trenton Iron Company on projects in the western United States, Canada, and Mexico; from 1909 to 1914, general manager of the Santa Eduviges Mining Company in Mexico; and from 1914 to 1916, sales engineer for the American Steel and Wire Company in Denver, Colo. In 1917 he became assistant engineer for the Erie Railroad in Cleveland, remaining in that capacity until his retirement in June 1945.

Leslie Lou LeVeque (Assoc. M. '22) president of the L. L. LeVeque Company, of Columbus, Ohio, was killed in an airplane accident on May 22, 1946. Mr. LeVeque, who was 53, had been president of the general contracting company bearing his name since 1921. Earlier he was with A. Bentley and Sons Company and the H. J. Spieker Company, of Toledo, and during the first World War served overseas with the Corps of Engineers, U.S. Army.

James Henry Stewart Melville (M. '22) died in Ridgefield, Conn., on April 17, 1946, at the age of 67. Mr. Melville was born in Jamaica, B.W.I., and spent his early engineering career there and with the Royal Engineers (Army). Coming to this country in 1906, he was with the New York Central and Hudson River Railroad Company and with Westinghouse, Church, Kerr, and Company, Inc., of New York City. From 1921 to 1940 he was with the New York consulting firm of Coverdale and Colpitts, and more recently had been supervising engineer for the Defense Plant Corporation in New Orleans, La., and Louisville, Ky.

Joe Clifton Moseley (Jun. '40) first lieutenant, Field Artillery, U.S. Army, was killed in an airplane crash on Luzon Island in the Philippines on November 7, 1945. He was 27. Following his graduation from the Agricultural and Mechanical College of Texas in 1940, Lieutenant Moseley became a draftsman for the Humble Oil and Refining Company at Baytown, Tex. Later he was junior engineer for the organization, and in 1943 he entered the Army.

Henry Cyrus Porter (M. '26) research engineer for the Texas State Highway Department, Austin, Tex., died on May 31, 1946. Mr. Porter, who was 59, recently received a certificate of honor from the Texas State Highway Department for twenty-five years of meritorious service. Since 1932 he had lived in Austin and held the position of research engineer in soil mechanics and foundations. Earlier in Mr. Porter's career he was engaged in railroad work, and from 1913 to 1917 he was city engineer of Kingsville, Tex.

Ralph Noble Priest (Assoc. M. '23) of Gwynedd Valley, Pa., died on May 14, 1946, at the age of 63. Early in his career Mr. Priest was with Amos W. Barnes, of Philadelphia, in charge of the design and construction of various projects in Philadelphia and Atlantic City and of the details for a lift bridge across the Chicago River at Chicago, and from 1911 to 1916 was with the W. E. Wark Company. Beginning in 1916, he was for a number of years in private practice as a structural engineer in Philadelphia.

Roy Major Alexander Ruddell (Jun. '41) lieutenant, U.S. Marine Air Corps, was reported missing in action in the Solomon

Islands as of November 11, 1942, and officially declared dead on February 19, 1945. Lieutenant Ruddell, who was 24, received the degree of B.S. in C.E. from the University of Colorado in 1941. He was the recipient of the Distinguished Flying Cross for heroism in shooting down three Japanese aircraft against great odds.

James Crisp Akers Salter (Jun. '42) captain, Air Force, U.S. Army, was killed in action a few days before the end of the war in the Pacific. His age was 25. Following his graduation from Clemson College in 1942, with the degree of B.C.E., Captain Salter entered the U.S. Army Air Force. His home was in Atlanta, Ga.

Baird Snyder, III (Assoc. M. '29) assistant administrator of the Federal Works Agency, Washington, D.C., died at his home in Westmoreland Hills, Md., on May 18, 1946. Mr. Snyder, who was 46, was for some years president of his own organization, the Snyder Engineering Company. Since 1935 he had been in government service, having held engineering posts with the Resettlement Administration, the Farm Security Administration, and the Department of Labor. In 1941 he became assistant administrator of the Federal Works Agency and director of the Agency's war public works program. At times he had served as acting administrator.

Benjamin Franklin Sparks (M. '41) coordinator of mines for the War Production Board at Escanaba, Mich., died on May 1, 1946, at the age of 60. From 1910 to 1933 Mr. Sparks was a consulting mining engineer—first as a firm member of the Smith-Sparks Construction Company and, later, of the Holmes-Sparks Construction Company—in the Upper Peninsula of Michigan. He then became Upper Peninsula engineer for the Michigan State Highway Department, resigning in 1943 to become connected with the War Production Board.

Fred Lincoln Stearns (M. '26) of Framingham, Mass., died on March 21, 1946, at the age of 79. From 1895 to 1919 Mr. Stearns was with the New York City Department of Street Cleaning, and from 1919 to 1924 he was Deputy Collector of Internal Revenue for the Commission of Internal Revenue. In the latter year he joined the engineering staff of the Third Avenue Railroad Company in New York, remaining with that organization until 1936.

Maximilian Toch (Affiliate '03) president and chief chemist of Toch Brothers, Inc., New York, N.Y. died in that city on May 28, 1946. Dr. Toch, who was 81, was internationally recognized for his achievements in organic and industrial chemistry. He had been professor of applied chemistry at Cooper Union and special lecturer at the University of Peking and the National Institute of Technology in China. An authority on the chemistry of paints, he is credited with developing the original battleship gray formula used by the U.S. Navy, and during the first World War was called America's first camofleur. He had charge of camouflage of the East Coast defenses at that time, and developed the Toch system of camouflage.

Lee Treadwell (M. '96) retired civil engineer of Atlanta, Ga., died at his home in that city on May 15, 1946, at the age of 81. A pioneer in bridge construction, Mr. Lee was for a number of years with J. A. L. Waddell, New York consultant, as resident engineer on the construction of numerous bridges in the West and Middle West. Later he established the Union Bridge Construction Company in Kansas City, and was vice-president and chief engineer of the organization. He retired in 1933 and moved to Atlanta.

Victor Griesa Walling (Assoc. M. '39) lieutenant, Civil Engineer Corps, U.S. Naval Reserve, died on board the *U.S.S. General T. H. Bliss* in the Pacific area on April 24, 1944. He was 36, and an alumnus of the University of Kansas. Before entering the Navy in 1942, Lieutenant Walling was for several years division superintendent for the Chicago Surface Lines. While in the Navy he served with the Twentieth Construction Battalion, based at Noumea, New Caledonia, and he was the holder of the Asiatic-Pacific Area Campaign Medal. He became a full lieutenant in October 1943. His home was in Chicago.

Changes in Membership Grades

Additions, Transfers, Reinstatments, and Resignations

From May 10, to June 10, 1946, Inclusive

Additions to Membership

Abonyi, Erwin (Jun. '46), Designer-Draftsman, Combustion Eng. Co., 200 Madison Ave., New York (Res., 25-75 Thirty-Third St., Long Island City 2), N.Y.

Ahrens, Herbert Emmett (Assoc. M. '46), Engr., U.S. Engr. Dept., Box 59 (Res., 2921 Dundee Road), Louisville, Ky.

Amrhein, James Edward (Jun. '45), Ensign, CEC, U.S.N.R., 1870 Greene Ave., Brooklyn, N.Y.

Bennett, Newcomb Benjamin, Jr. (Assoc. M. '46), Acting Asst. Director, Branch of Project Planning, Bureau of Reclamation, New Interior Bldg., Washington, D.C. (Res., 2019 Powhatan Rd., West Hyattsville, Md.)

Blaes, Frank Eugene (Jun. '45), 2570 Fowler Ave., Ogden, Utah.

Blankenship, Wilbur Lee Shelton (M. '46), Chf., Bureau of Sewers and Structures, Dept. of Public Works, City of Richmond, 217 Governor St. (Res., 804 West 29th St.), Richmond 24, Va.

Brown, Elgar Parnell (Jun. '46), Structural Draftsman, Ohio State Univ., Brown Hall, Ohio State Univ. (Res., 972 East 19th Ave.), Columbus 3, Ohio.

Burton, William Wallace (Jun. '46), Ensign, CEC, U.S.N.R. 17200 Lakewood Heights Blvd., Lakewood 7, Ohio.

Burghardt, King (M. '46), Highway Bridge Engr., Public Roads Administration, 615 Midland Savings Bldg., Denver 2, Colo.

Calderara, Oral Joseph (Assoc. M. '45), San. Engr. (R), Public Health Specialist in Chg., U.S. Public Health Service, Liaison Officer, War Assets Administration, 699 Ponce de Leon Ave., North East, Atlanta, Ga.

Carey, Homer Frank (M. '46), Chf., Structures Branch, Office, Chf. of Engrs., War Dept., Temporary H Bldg., Washington, D.C. (Res., 7 Thoreu Drive, Bethesda 14, Md.).

Carter, Paul Lewis (Jun. '46), Ensign, U.S.N.; 1006 North Cunningham, Urbana, Ill.

Castro, Fernando (Assoc. M. '46), Civ. Engr., Puerto Rico Water Resources Authority, San Juan (Res., Box 3482 Santurce), Puerto Rico.

Conner, Robert Edward (Jun. '46), Junior Structural Designer, Brandow & Johnston, Chamber of Commerce Bldg., Los Angeles (Res., 30 South Lima St., Sierra Madre), Calif.

Cook, Richard Wallace (M. '46), 2168 Denmark St., Oak Ridge, Tenn.

Cook, Rudyard Merwin (Assoc. M. '46), Lecturer, Northwestern, Technological Inst., Evanston, Ill.

Costa, Raymundo Jose d'Araujo (Jun. '46), Civ. Engr., Geotecnica Ltda., Rua Libero Badaro, 158-s . . 1802 (Res., Rua doe Bororos, 60), Sao Paulo, Brazil.

de Cereville, Henri Bernard (Assoc. M. '46), Civ. Engr. (Henri B. de Cerenville), Vieux Bellevue, Bethusy, Lausanne, Switzerland.

Didrence, Joseph Jay (Assoc. M. '46), Engr. (Civ.), War Dept., U.S. Engr. Office, Box 3821, Miami, Fla.

Dougherty, Edward A. (M. '46), Chf. Engr., New York Central System, Room 425, La Salle St. Station, Chicago 5, Ill.

Enewold, Lee Roy (Jun. '46), Ensign, U.S.N.R., 2565 South Cherokee St., Denver, Colo.

Feeney, Joseph Leland (Jun. '45), Ensign, U.S.N.R.; 1139 South Ardmore Ave., Los Angeles, Calif.

Ferguson, Duncan Stuart (Assoc. M. '45), Maj., Royal Engrs., Senior Engr., Drainage and Irrig. Dept., Colonial Govt. Service, Kuala Lampur, Malaya.

Forrest, Donald Roger (Jun. '46), Chf., Survey Section, Eng. Div., Honolulu Dist. Engr. Office, U.S. Engr. Dept., Box 2240, Honolulu, Hawaii.

Friedgen, Clemens Francis (M. '46), Group Supervisor, E. I. du Pont de Nemours & Co., 11502 Nemours Bldg., Wilmington 98, Del.

Giles, William Hughes (M. '46), Engr. of Design, Mo. Pac. R.R. Co., 1200 Mo. Pac. Bldg., St. Louis 3, Mo.

Gordon, Grant Peck (M. '46), Constr. Engr. Bureau of Reclamation (Res., 1301 Crescent Rim Drive), Boise, Idaho.

Griffin, Gilbert Arthur (Assoc. M. '46), Dist. Mgr., Morrison-Knudsen Co., Inc., 603 Hoge Bldg., Seattle 4, Wash.

Gurley, Norman Bassett (M. '46), Chf. Engr., Lando Coal Corp. & Affiliates, Guaranty Bank Bldg. (Res., 1472 Edwards St.), Huntington 1, W.Va.

Hall, Gerald D. (Assoc. M. '46), (G. D. Hall & Associates, Cons. Engrs.), Larson Bldg., Yakima, Wash.

Harker, David Hendley (M. '46), Chf. Engr., State Flood Control and Water Resources Comm., 522 Board of Trade Bldg., Indianapolis, Ind.

Hatton, Hannibal Sanford (M. '46), Div. Engr., Reconstruction Finance Corp., 719 Cotton Exchange Bldg., Dallas, Tex.

Henegar, Herbert Benton (M. '46), Chf. Engr., Tennessee Copper Co., Copperhill, Tenn.

Hirst, Daniel Lee (Jun. '46), Ensign, U.S.N.R., 1028 North Kenmore, Los Angeles 27, Calif.

Houze, Gerald Lucian (Assoc. M. '46), Design Engr., Pittsburgh-Des Moines Steel Co. (Res., 119 Union Ave.), Pittsburgh 5, Pa.

Hull, Noah Elder (M. '46), Plant Engr., The Hughes Tool Co., 5425 Polk Ave. (Res., 2028 Branard), Houston 6, Tex.

Hurley, Elmer Ernest (Assoc. M. '46), Res.

TOTAL MEMBERSHIP AS OF JUNE 10, 1946

Members	6,390
Associate Members	8,264
Corporate Members	14,654
Honorary Members	36
Juniors	6,616
Affiliates	76
Fellows	1
Total	21,383
(June 11, 1945	20,845)

Engr., State Highway Comm., Highway Bldg., Little Rock (Res., 416 Lyons Lane, Camden), Ark.

Hutchins, James Gordon, Jr. (Jun. '46), Junior Constr. Engr., Day & Zimmermann, Inc., Vine and Railroad Ave. (Res., 2883 Harrison Ave.), Cincinnati, Ohio.

Johnson, Robert E. Lee (Assoc. M. '46), Design Engr., City of Houston, 711 City Hall (Res., 1615 McDuffie), Houston 6, Tex.

Kelley, William Denison (M. '46), Cons. Engr., 410 Chamber of Commerce Bldg., Charleston, W.Va.

Kennie, Frank Davis (M. '46), Chf. Engr., Eastern Lines, Atchison, Topeka and Santa Fe Ry. Co., 920 Jackson St., Topeka, Kans.

Kerlin, Walter Claude (M. '46), Senior Constr. Engr., Chemical Warfare Service, Pine Bluff Arsenal, Arsenal, Ark.

Lewis, Abraham Barton (Jun. '46), 501 West 19th St., Wilmington 23, Del.

Looper, Joseph Henry (Jun. '46), Ensign, U.S.N.R.; Lovell, Wyo.

Lord, Kenneth Thomas (Assoc. M. '46), Civ. Engr. P-4, U.S. Engr. Office, Army Post Office 851, Care, Postmaster, Miami, Fla.

Martin, Felix Joseph (Assoc. M. '46), Chf. Engr., Mississippi River Fuel Corp., 407 North 8th St., Room 916, St. Louis, Mo.

Mathews, Lewis Earl (Jun. '45), Draftsman, Webber and Co., 606 South Hill St. (Res., 1100 West 40th Place), Los Angeles 37, Calif.

May, William Thornton King (Assoc. M. '46), Director of Technical Service, West Coast Lumbermen's Assn., Portland, Ore.

Mims, Harry McCullough (M. '46), Mgr. and Vice-Pres., J. F. Cleckley and Co., Orangeburg, S.C.

Most, Burton Bourdon (Jun. '46), Asst. Engr., *U.S.S. Tortuga*, LSD 26, Fleet Post Office, San Francisco (Res., 2041 Park Drive, Los Angeles 26), Calif.

Navas, Stanley Ralph (Jun. '46), Asst. Sales Mgr., Concrete Pipe and Products Co., Box 1223, Richmond 9, Va.

Neff, Cyril William (Assoc. M. '46), Civ. Engr., State Dept. of Highways, 516 Auditorium Bldg., Cleveland (Res., 4006 Albertly Ave., Parma 9), Ohio.

Pasquarelli, Jerome Peter (Jun. '46), 3257 Hull Ave., New York 67, N.Y.

Pipkin, William Kirk (Jun. '46), Bridge Designer, State Highway Dept., 800 Highway Bldg. (Res., 508 Elmwood Place), Austin 21, Tex.

Potter, William Everett (M. '46), Col., Corps of Engrs., U.S. Army, Dist. Engr., U.S. Engr. Office, 601 Davidson Bldg., Kansas City, Mo.

Raynor, Paul Charles (Jun. '45), Asst. Structural Engr., Eastman Kodak Co., Kodak Park (Res., 163 Ridgeway Ave.), Rochester 13, N.Y.

Ready, William Charles (M. '46), Lt. Col., Corps of Engrs., U.S. Army, Asst. Div., Engr., Middle Atlantic Div., Corps of Engrs., 909 Calvert Bldg., Baltimore, Md.

Scurr, Kenneth Russell (M. '46), State Bridge Engr. State Highway Comm., State Capitol, Pierre, S.Dak.

Seaman, Francis Eugene (Assoc. M. '46), Asst. Engr. to Engr. in Chg. Physical Research, Ohio Highway Testing and Research Laboratory, Ohio State Univ. Campus, Columbus, Ohio.

Seavy, Hansford Paul (M. '46), Engr. and Associate Partner, Seth E. Giem, Gen. Contr., Porter Bldg., Cape Girard, Mo.

Shewbridge, Wellford Hope (Assoc. M. '46), Asst. Engr., State Health Dept., Room 708, State Office Bldg. (Res. 1506 Greycourt Ave.), Richmond 22, Va.

Strudwick, Fred Nash, Jr. (Jun. '46), Asst. Engr., Southern Materials Corp. (Res., 237 Camden Ave.), Salisbury, Md.

Thompson, George Conklin (Jun. '46), Ensign, U.S. Navy, 130 Fulton St., Palo Alto, Calif.

Varey, Edmund Berton (Jun. '46), Associate, Univ. of Washington (Res., 6551 Seventeenth North East), Seattle 5, Wash.

Volkovisky, Isaac (Assoc. M. '46), Asst. Head Hydr. Engr., Water Research Bureau of the Jewish Agency for Palestine and Jewish National Fund, Box 283 (Res., 4 I bn Gabirol St.), Jerusalem, Palestine.

Waggoner, William Lawrence (Jun. '46), Asst. to J. B. Regen, Gen. Contr., 127 Fifth Ave., North (Res., A-7 Woodmont Terrace), Nashville 4, Tenn.

Waldbiesser, William Carl (Jun. '46), Junior Engr., U.S. Geological Survey, 211 Car Savings & Loan Bldg. (Res., 416 West Main St.), Lansing 15, Mich.

Waller, Irle Irwin (Assoc. M. '46), Cons. Engr., 127 North Dearborn St., Chicago 2, Ill.

Williams, Herbert Childs (Jun. '46), Ensign, U.S.N.R., Com Marianas, Box 11, Care, Fleet Post Office, San Francisco, Calif.

Woods, John Emerson (Assoc. M. '46), Pres., Woods, Inc., Bldrs. and Gen. Contrs., 846 Farmington Ave., West Hartford (Res., Litchfield Rd., Norfolk), Conn.

Yates, Robert Raleigh (M. '46), Capt., CEC, U.S. Navy, Public Works Dept., New York Naval Shipyard, Brooklyn 1, N.Y.

Ziebold, Harold Oscar (Assoc. M. '46), Asst. Chf. Engr., Mississippi River Fuel Corp., 407 North 8th St., Room 916, St. Louis 1, Mo.

Membership Transfers

Abbey, Chester Edward (Jun. '32; Assoc. M. '46), Research Engr., Gypsum Assn., 211 West Wacker Drive Room 800 (Res., 6538 North Glenwood Ave.), Chicago 26, Ill.

Byrne, Ralph Edward, Jr. (Jun. '34; Assoc. M. '46), Mathematical Consultant, Bartelt Eng. Service (Res., 1840 Rural St.), Rockford, Ill.

Cartelli, Anthony Raymond (Jun. '36; Assoc. M. '46), Designer, Checker, Detailer, Parsons, Brinckerhoff, Hogan & Macdonald, 75 Fulton St. (Res., 173 East 165th St.), New York 56, N.Y.

Conwell, James Alexander (Jun. '33; Assoc. M. '46), 4706 Vista St., San Diego 4, Calif.

Digiacinto, Albert George (Jun. '33; Assoc. M. '39; M. '46), Senior Engr., Spencer, White & Prentis, Inc., Engrs. and Contrs., 10 East 40th St. (Res., 1336 Noble Ave.), New York 60, N.Y.

Fischer, Ernest William (Jun. '38; Assoc. M. '46), Maj., Corps of Engrs., U.S. Army; 812 North Whitmore Ave., Baltimore 16, Md.

Glass, Sherman (Jun. '37; Assoc. M. '46), 264 Ryerson St., Brooklyn 5, N.Y.

Gray, Nomer (Assoc. M. '40; M. '46), Engr.-in-Chg., Structural Design Section, Bureau of Bridge Design, Dept. of Public Works, Municipal Bldg., Room 1330, New York, N.Y.

Harris Richard John (Jun. '31; Assoc. M. '46), Asst. Engr., Clark, Rapuano & Holleran, 145 East 32d St., New York, N.Y. (Res., 234 Holmes St., Belleville 9, N.J.)

Holton, Hyrum Perry (Jun. '36; Assoc. M. '45), Civ. Engr. (P-2), U.S. Engrs. Office, Box 80 (Res., Route 2, Box 207), Vicksburg, Miss.

Hopkins, Leonard Otis, Jr. (Jun. '37; Assoc. M. '46), Structural Engr., Schmidt, Peerson & Hedman, Engrs., 214 Chattanooga Bank Bldg. (Res., 807 South Moore Rd.), Chattanooga, Tenn.

Isto, Reynold Edward (Jun. '36; Assoc. M. '46), Associate Topographic Engr., Topographic Branch U.S. Geological Survey, Room 6344 North Interior Bldg., Washington 25, D.C. (Res., Box 133, Rolla, Mo.)

Johnson, Emory Emmanuel (Jun. '36; Assoc. M. '46), Asst. Prof. of Civ. Eng., Univ. of Kansas, 209 Marvin Hall, Univ. of Kansas (Res., 1709 Indiana St.), Lawrence, Kans.

Lamb, George William (Assoc. M. '36; M. '46), Dist. Engr., Am. Inst. of Steel Constr., Inc., 630 New England Bldg., Topeka, Kans.

Lang, Edmund Herman (Jun. '39; Assoc. M. '46), Hydr. Engr., U.S. Engr. Office, 1709 Jackson St., Omaha 2, Nebr.

Larkin, Franklin Jonathan (Jun. '34; Assoc. M. '46), Supt., Cont. Div., Dravo Corp., South Capitol and R Sts., S.E., Washington, D.C.

Meszaros, Leslie Joseph Michael (Jun. '37; Assoc. M. '46), 19 York Drive, Piedmont, Calif.

Perliter, Simon (Jun. '25; Assoc. M. '31; M. '46), (Perliter and Soring, Engrs.), Room 511 Central Bldg., 108 West 6th St., Los Angeles 14, Calif.

Redon, Alexander Louis (Jun. '35; Assoc. M. '46), Comdr., U.S.N.R.; 2667 Le Page St., New Orleans 19, La.

Sette, Thomas Joseph (Jun. '39; Assoc. M. '46), Constr. Supt., Garry & Co., Roslyn (Res., 3739 Ninety-fifth St., Jackson Heights), N.Y.

Spears, Ralph Westly (Jun. '40; Assoc. M. '46), Office Engr., Military Design Section, U.S. Engr. Office, Davidson Bldg., Kansas City, Mo. (Res., 5606 Roeland Parkway, Mission, Kans.)

Swiger, William Frederick (Jun. '30; Assoc. M. '46), Engr., Structural Div., Stone & Webster Eng. Corp., 49 Federal St., Boston 7, Mass.

Reinstatements

Barron, Maurice, M., reinstated May 20, 1946.

Cotten, Shepard Marrast, M., reinstated May 31, 1946.

Dreyfus, Samuel Cellner, Assoc. M., reinstated May 31, 1946.

Hawley Robinson Wilber, M., reinstated May 15, 1946.

Jennings, Charles Harold, Assoc. M., reinstated May 20, 1946.

Kenny, James Stephen, M., reinstated May 20, 1946.

Lee, Don, Assoc. M., reinstated May 29, 1946.

Mullin, Jerome Alexander, M., reinstated May 20, 1946.

Nagle, John Marion, M., reinstated May 31, 1946.

Change of Address

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Mailing and Publications to ☐ Home ☐ Business

Listing in Yearbook to include:

☐ Home only ☐ Business only ☐ Home and Business

PEERSON, JOHN WILLIAMS, M., reinstated May 20, 1946.

SCACCIAFERRO, SALVATOR JOHN, Assoc. M., reinstated May 27, 1946.

WEEKS, LUCAS ALFRED, Assoc. M., reinstated May 31, 1946.

RESIGNATIONS

BAUER, GEORGE JACKSON, Jun., resigned June 5, 1946.

BIRNBAUM, ARNOLD, Jun., resigned May 13, 1946.

BOEHRINGER, ROBERT AMOS, M., resigned May 16, 1946.

BRINGHURST, GEORGE RUTHVEN, Assoc. M., resigned May 15, 1946.

CASSELL, DAVID BENNETT, JR., Assoc. M., resigned May 16, 1946.

CHURCH, GAYLORD, Assoc. M., resigned May 15, 1946.

COPELAND, JAMES TRACY, Jun., resigned May 21, 1946.

FISHBURN, CYRUS CHARLES, Assoc. M., resigned May 14, 1946.

GROCHAU, EARL HENRY, Assoc. M., resigned May 10, 1946.

HAYES, MORGAN DODGE, M., resigned May 14, 1946.

KELLEY, BRUCE WARREN, Jun., resigned June 1, 1946.

MASUR, ERNEST FRANK, Jun., resigned May 27, 1946.

MONTGOMERY, MELVIN HENRY, Jun., resigned May 17, 1946.

MORTENSEN, CARL JULIUS, Jun., resigned May 14, 1946.

NEMMERS, ELMER JOHN, Jun., resigned May 27, 1946.

WESTRA, GEORGE DAVID, Assoc. M., resigned May 14, 1946.

WILKES, JAMES HARLEY, Jun., resigned May 27, 1946.

Applications for Admission or Transfer

Condensed Records to Facilitate Comment from Members to Board of Direction

JULY 1, 1946 NUMBER 7

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every Member is urged, therefore, to scan carefully the list of candidates published each month in CIVIL ENGINEERING *and to furnish the Board with data which may aid in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know the applicant personally as well as upon the nature and extent of his professional experience. Any facts derogatory to the personal character or professional reputation of an applicant should by promptly communicated to the Board.

Communications relating to applicants are considered strictly confidential.

The Board of Direction will not consider the applications herein contained from residents of North America until the expiration of 30 days, and from non-residents of North America until the expiration of 90 days from the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

GRADE	GENERAL REQUIREMENT	AGE	LENGTH OF ACTIVE PRACTICE	RESPONSIBLE CHARGE OF WORK
Member	Qualified to design as well as to direct important work	35 years	12 years	5 years RCM*
Associate Member	Qualified to direct work	27 years	8 years	1 year RCA*
Junior	Qualified for subprofessional work	20 years	4 years	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years	5 years RCM*

* In the following list RCA (responsible charge—Associate Member standard) denotes years of responsible charge of work as principal or subordinate, and RCM (responsible charge—Member standard) denotes years of responsible charge of IMPORTANT work, i.e., work of considerable magnitude or considerable complexity. The time statements shown are as presented by the applicant.

APPLYING FOR MEMBER

ANDREWS, CARL HANSON, Dallas, Tex. (Age 42) (RCA 6.5 RCM 8.7) June 1929 to Aug. 1942 and March 1946 to date with U.S. Army Engrs.; in the interim Capt., Major, and discharged as Lt. Col., U.S. Army.

BATY, JAMES BERNARD, Washington, D.C. (Age 43) (RCA 4.0 RCM 11.1) June 1942 to date with San. Corps, U.S. Army, at present as Major, being Post San. Officer.

BOOTH, CHESTER EDWIN, New York City. (Age 61) (RCM 25.9) March 1945 to date Civ. Engr., Ebasco Services, Inc., New York City; previously Senior Civ. Engr., Bureau of Yards & Docks, Navy Dept.

BROWN, BARNEY BIVINGS, Little Rock, Ark. (Age 46) (RCM 17.4) June 1945 to date Engr., K. W. Lefever, Little Rock, Ark.; previously Constr. Engr., Supt. for Post Engr., etc., CWS, Pine Bluff Arsenal; Engr. and Supt. Associated Archts., Little Rock; with WPA.

BURKE, JASPER RICHARD, Staten Island (1), N.Y. (Age 41) July 1941 to date with USNR, at present as Comdr.; previously with Board of Water Supply and Board of Transportation, New York City.

COGAN, MYLES HONOHAN RESUGGAN, (Assoc. M.), Houston, Tex. (Age 44) (RCM 17.4) Feb. 1943 to date Engr., Shell Oil Co., Deer Park, Houston; previously Asst. Chf. Engr., Anglo-Egyptian Oilfields Ltd., Suez, Egypt.

COHN, AUGUST, Ft. Worth, Tex. (Age 61) (RCA 6.8 RCM 23.8) Feb. 1934 to date, consecutively with PWA and FWA, at present passing on adequacy of completed plans and specifications submitted.

COLBY, EDWIN WHITMORE, Wellesley Hills, Mass. (Age 55) (RCA 14.5 RCM 18.0) 1918 to date with J. R. Worcester & Co., Boston, Mass.

CORNELL, ERLING ALARIC, Dallas, Tex. (Age 39) (RCA 2.0 RCM 8.8) Oct. 1939 to date with U.S. Engrs., since April 1942 with Corps of Engrs., U.S. Army, as Capt., Major, and Lt. Col.

CRANE, FREDERICK WILSON, Buffalo, N.Y. (Age 50) (RCA 15.6 RCM 10.0) Sept. 1923 to date with City of Buffalo, N.Y., since Jan. 1946 as City Engr.

FOLLETT, DONALD GORDON (Assoc. M.) Swarthmore, Pa. (Age 50) (RCA 2.2 RCM 17.7) May 1942 to date Lt. Comdr. and Comdr., CEC U.S. Navy; previously with Board of Water Supply, New York City.

FORSYTH, JOSEPH ROBERT (Assoc. M.) Brooklyn, N.Y. (Age 58) (RCA 5.8 RCM 16.5) Aug. 1945 to date Designing Engr., Morris Knowles, Inc., Pittsburgh, Pa.; previously Senior Engr. (D-6), Water Div., Office of War Utilities, War Production Board, Washington, D.C.; Consultant, Buck, Seifert & Jost, New York City; Designer, Wilputte Coke Oven Corporation, New York City; with New York City Board of Water Supply.

FOSTER, EDWARD TERENCE (Assoc. M.) Omaha, Neb. (Age 41) (RCA 6.0 RCM 11.2) Jan. 1946 to date President, Foster-Smetana Co., Omaha, Neb.; previously Col., U.S. Army.

FYE, RUSSELL CODDINGTON, Omaha, Nebr. (Age 47) (RCA 4.0 RCM 21.4) Dec. 1945 to date with 7th Service Command, A.S.F., Omaha, Neb., since April, 1946 being chf. of Maintenance & Repair Branch; previously Lt. Commdr., U.S. Navy.

HARTLEY, ROBERT WILLARD (Junior) Washington, D.C. (Age 35) (Claims RCA 5.3) June 1944 to date with U.S. Dept. of State; previously Prin. Budget Examiner (Inspector) War Project Unit, U.S. Bureau of the Budget; with U.S. National Resources Planning Board finally as Prin. Engr. (P-6), Federal Program Sec.

HAUF, HAROLD DANA, Yale Univ., New Haven, Conn. (Age 41) (RCA 5.8 RCM 8.2) Oct. 1929 to June 1941 and Nov. 1945 to date with Yale Univ., after July 1939 as Associate Prof.; in the interim with CEC, USNR, at present Commdr.

HERTENSTEIN, WESLEY CHARLES (Assoc. M.) Pasadena, Calif. (Age 44) (RCA 3.0 RCM 13.0) 1936 to date with California Inst. of Technology, since 1938 as Supt. of Bldgs. and Grounds.

HUNT, ELDON VAIDEN, Ithaca, N.Y. (Age 42) (RCA 9.6 RCM 6.0) March 1946 to date Graduate Student, Cornell Univ., Ithaca, N.Y.; previously with Corps of Engrs., U.S. Army, finally as Col.

HUTTO, WALTER CLYDE (Assoc. M.) Lexington, S.C. (Age 39) (RCA 6.3 RCM 5.7) June 1945 to date Co-Owner of B. & H. Equipment Co., West Columbia, S.C.; previously Designer, S.C. Highway Dept.; Instructor, Alabama Pol. Inst., Auburn, Ala.; Associate Structural Engr., TVA, Knoxville, Tenn.

JORDAN, JOSEPH ALEXANDER (Assoc. M.), New York City, N.Y. (Age 49) (RCA 17.6 RCM 6.9) at present Constr. Supt., Chas. H. Tompkins Co., Washington, D.C.; previously Engr. Group Leader, Smith-Hinchman & Grylls, Bureau of Ships, U.S. Navy; with the Kellex Corporation, Oakridge, Tenn.; with McAvoy Shipbuilding Co., Savannah, Ga.

KAMPMEIER, ROLAND AUGUST (Assoc. M.), Chattanooga, Tenn. (Age 35) (RCA 3.0 RCM 6.9) July 1941 to date Chf., Power Economics Div., TVA.

KAROL, JACOB (Assoc. M.), Kansas City, Mo. (Age 38) (RCA 1.2 RCM 9.1) June 1938 to April 1942 Designer, and July 1945 to date Design Engr., Howard, Needles, Tammen & Bergendoff, Kansas City, Mo.; in the interim with Curtiss-Wright Corp., Airplane Div., St. Louis, Mo.

KEY, CLYDE CECIL (Assoc. M.), Baltimore, Md. (Age 50) (RCA 4.5 RCM 17.0) April 1932 to date with PBA, FWA, Washington, D.C., since Feb. 1941 as Prin. Engr.

KULIN, HARVEY JULIUS (Junior), Indianapolis, Ind. (Age 34) (RCA 3.2 RCM 5.4) April 1946 to date Dist. Engr., Infilco, Inc., Chicago; previously Major, U.S. Army; San. Engr., American Well Works, Aurora, Ill.

LA BELLE, WALTER ERNEST (Assoc. M.), Bethlehem, Pa. (Age 38) (RCA 5.7 RCM 6.3) Aug. 1932 to date with Bethlehem Steel Co., since Feb. 1940 as Asst. to Gen. Manager, Fabricated Steel Constr. Div.

LAYCOCK, JOHN NOBLE, Derry, N.H. (Age 49) (RCM 27.6) March 1917 to date with CEC, U.S. Navy at present as Capt. (retired); previously Commdr., etc.

LORENTE, MARIANO JOAQUIN, Boston, Mass. (Age 63) (RCA 9.2 RCM 29.2) March 1945 to date Chf. Structural Engr., Cram & Ferguson, Boston, Mass.; previously Structural Designer, Bethlehem Steel Co., Quincy, Mass.

LYNN, CHARLES FERGUSON (Assoc. M.) (Age 41) (RCM 6.8) Nov. 1933 to Feb. 1943 and Oct. 1945 to date County Engr., Richland County, S.C.; in the interim, Lt. and Capt., U.S. Marine Corps, Reserve (US-ECM).

MCMAHON, JAMES EMMETT (Assoc. M.), Long Beach, Calif. (Age 36) (RCA 2.7 RCM 8.4) Jan. 1946 to date Assoc. Bridge Engr. for State of California; previously, Lt., Lt.-Commdr., and Commdr., CEC, Bureau of Yards & Docks, U.S. Navy.

MILLER, ARTHUR LESLIE (Junior), Oceanside, Calif. (Age 35) (RCA 6.0 RCM 5.7) March 1944 to date with Haddock-Engineers Ltd., Oceanside, Calif.; since Feb. 1945 as Chf. Engr.; previously Project and Chf. Estimator on Naval Air Station construction.

NOWELL, JOSEPH CORNELL, JR. (Assoc. M.) Schenectady, N.Y. (Age 45) (RCA 0.5 RCM 10.2) At present Asst. Mgr., Eng. Dept., Gen. Elec. Realty Corporation, Schenectady, N.Y.; previously, Lt. Commdr. and Commdr., CEC, USNR; with TVA.

NUFFER, LLOYD JACOB, Ogden, Utah. (Age 44) (RCA 6.9 RCM 6.7) May 1944 to date Office Engr., Ogden (Utah) Eng. Dept.; previously Eng. Inspector, Hodgson, Ashton, Evons, Blanchard, Mayer and Clyde C. Kennedy, Archt. Engrs., Clearfield, Utah; Design Engr. with Leslie S. Hodgson, Archt.

PATERSON, WALTER HOWARD, Toronto, Ont., Canada. (Age 37) (RCA 2.7 RCM 8.9) July 1942 to date with Toronto (Ont.) Transportation Co., since Jan. 1946 as Engr. of Rapid Transit; previously with Tropical Oil Co., Colombia, South America.

PENDERGRAFT, CARL BOUCHER, Little Rock, Ark. (Age 48) (RCA 7.3 RCM 15.2) Nov. 1944 to date Field Engr., K. W. Lefever Engr., Little Rock, Ark.; previously, Office Engr., MacCrea-Bair-Lefever, Little Rock, Ark.

PLETTA, DAN HENRY (Assoc. M.), Blacksburg, Va. (RCA 11.0 RCM 5.3) 1942 to date Officer, U.S. Army, at U.S. Military Academy, West Point N.Y., at present as Asst. Director, 3rd class cadets; previously, Asst. Prof., Virginia Polytechnic Inst.

REID, GRAEME (Assoc. M.), Chevy Chase, Md. (Age 42) (RCA 6.8 RCM 9.7) Feb. 1943 to date Lt., etc. to Commdr., U.S. Navy, since Aug. 1943, being Administrative Asst. and Asst. Head, Contr. Div., Bureau of Yards & Docks; previously, Cons. Transportation Engr. (private practice), Essex Fell, N.J.

RINNE, VILJO JOHANNES, Helsinki, Finland. (Age 42) (RCA 11.0 RCM 7.1) Oct. 1938–April 1942 and Jan. 1945 to date Chf., Canal & Harbor Bureau, Central Board of Highways & Waterways; in the interim, Engr.-in-Chf., Saimaa Canal Reconstruction.

SCOTT, ROBERT GRAHAM (Assoc. M.) Chicago, Ill. (Age 47) (RCA 6.5 RCM 13.2) May 1936 to date Chf. Engr., Clay Products Association, Chicago, Ill.

SEYTON, HARRY JOHN, St. Paul, Minn. (Age 64) (RCA 1.0 RCM 36.2) April 1909 to date with Great Northern R.R., since Jan. 1946 as Chf. Engr.

SPADE, WALTER EMMETT (Assoc. M.), Neenah, Wis. (Age 41) (RCA 11.0 RCM 5.8) Sept. 1945 to date structural Engr., Kimberly-Clark Corporation, Neenah, Wis.; previously Draftsman and Inspector, Chicago, Rock Island & Pacific Ry.

SPENCER, RAYMOND DANA (Assoc. M.), San Marino, Calif. (Age 45) (RCA 0.8 RCM 20.2) March 1946 to date Engr., Koebig and Koebig Cons. Engrs., Los Angeles, Calif.; previously Col., U.S. Army, Corps of Engineers.

SWEENEY, RALPH CRISSMAN (Assoc. M.) Ft. Hayes, Columbus, Ohio. (Age 50) (RCA 6.2 RCM 13.3) May 1941 to date Lt. Col., San. Corps, U.S. Army; previously Dist. San. Engr., New York State Health Dept.

VAN PETTEN, ROBERT MILTON, Milwaukee, Wis. (Age 59) (RCA 6.6 RCM 12.2) Oct. 1943 to Feb. 1946, Div. Engr. (Structural) Kellex Corporation; previously, Chief Engr., Prin. Engr. (P-6), Corps of Engrs., U.S. Army; with U.S. Navy.

WEST, CARL MILAND, Olympia, Wash. (Age 38) (RCA 0.9 RCM 6.5) Jan. 1946 to date Bridge Design Engr., Washington State Dept. of Highways; previously, prisoner of war in Japan (4 years); Chf. Engr. on Guam, J. H. Pomeroy & Co., San Francisco, Calif.; Engr. on Design, Washington Toll Bridge Authority.

WOOLF, ABRAHAM (Assoc. M.), Boston, Mass. (Age 38) (RCA 1.2 RCM 6.5) Structural Engr. (private practice), Boston, Mass.; previously Production Engr., Liberty Optical Co.; Designing Structural Engr., Albert Kahn, Inc., Detroit, Mich.

WHITE, HAROLD HENRY, Mexico, D.F., Mex. (Age 47) (RCM 22.6) Oct. 1944 to date vice-pres., Atlas de Mexico; previously Cons. Engr., Atlas Powder Co., Wilmington, Del.

WILLIAMS, WILLIAM FRANCIS, El Paso, Tex. (Age 43) (RCA 8.3 RCM 7.8) July 1945 to date Engr. with International Boundary and Water Comm., El Paso, Tex.; previously with Texas Highway Dept., Austin, Tex.

APPLYING FOR ASSOCIATE MEMBER

AMBLER, EDWARD CAREY, JR., Richmond, Va. (Age 39) (RCA 5.1 RCM 2.5) June 1936 to Oct. 1941 and Jan. 1946 to date Valuation Engr., State Corporation Comm., Richmond, Va.; in the interim Officer, U.S. Army.

ARMSTRONG, URAL STOKES, Santa Fe, N.Mex. (Age 50) (RCA 11.5) May 1931 to date with New Mexico Highway Dept.

BANGHAM, WILLIAM LARRIBEE, Pasadena, Calif. (Age 45) (RCA 10.0 RCM 8.5) April 1946 to date Civ. Engr.; Conners & Co., Pasadena, Calif.; previously Engr. and Office Mgr. with Harold A. Barnett, Cons. Engr., Pasadena; with the M. W. Kellogg Co.

BATES, THOMAS ISAAC, JR. (Junior), Charleston, Tenn. (Age 32) (RCA 4.4) Feb. 1943 to date, Associate Engr., Dept. Comm., CAA; previously with FWA, PRA.

BULLINGTON, JAMES DOUGLAS, Athens, Ala. (Age 44) (RCA 12.7) Nov. 1944 to date County Engr., Limestone County, Alabama; previously with Alabama Highway Dept.

CALLAHAN, CLARENCE ANDREW (Junior), FPO, New York City. (Age 36) (RCA 0.8 RCM 4.3) May 1942 to date with U.S. Army, since June 1945 as Res. Officer in Chg. of Constr.; previously with U.S. Engr. Office, Kansas City, Mo.

COOPEY, MARTIN PORTMAN (Junior) Corvallis, Ore. (Age 35) (RCA 3.6) Jan. 1941 to date with Oregon State Coll., since Sept. 1944 as Asst. Prof. of Civ. Eng.; previously with USED.

DAS, PRAMATHA LAL, Bengal, India. (Age 34) (RCA 9.2) Dec. 1942 to date Asst. Inspecting Officer, MGO Br., New Delhi, India; previously Examiner of Stores, Indian Stores Dept., New Delhi.

DAVIS, HAROLD HERMAN, Detroit, Mich. (Age 32) (RCA 6.0 RCM 1.2) Jan. 1943 to April 1946, Lt., CEC, U.S. Navy; previously Structural Engr.; with Albert Kahn, Associated Architects and Engrs.

DWYER, THEODORE PAUL, Overland Park, Kans. (Age 34) (RCA 3.5 RCM 0.5) Oct. 1940 to date with the Fluor Corporation, Ltd.; previously Designing Draftsman, J. F. Pritchard & Co., Kansas City, Mo.

EHASZ, FRANK LOUIS (Junior), Queens, N.Y. (Age 34) (RCA 4.5) 1945 to date Asst. Engr., with O. H. Ammann, Cons. Engr., previously Structural Designer with W. Earle Andrews; Structural Design Engr., Sanderson & Porter, all in New York City.

EIDSON, ALVA EUGENE, Merriam, Kans. (Age 47) (RCA 4.6 RCM 5.3) Aug. 1943 to Dec. 1945 with the Fluor Corporation, Kansas City, Mo.; previously with Kansas Structural Steel Co., Kansas City, Mo.

ELSTON, JUDSON PALMER, Denver, Colo. (Age 33) (RCA 5.5 RCM 3.8) July 1936 to June 1942 and Jan. 1946 to date with U.S. Bureau of Reclamation in various positions, since Jan. 1946 as Engr.; in the interim Officer, U.S. Army, Corps of Engrs.

FENG, TSUAN HUA, Racine, Wis. (Age 28) (RCM 2.0) Jan. 1946 to date, with City of Racine as Student Engr., at present with Water Dept.; previously Asst. Engr., Communication Ministry of China at Chungking.

FIGILIS, JACK, Lakewood, Colo. (Age 34) (RCA 5.7 RCM 3.4) Jan. 1946 to date Structural Designer, Crocker & Ryan, Denver, Colo.; previously Structural Designer, Hillman & Nowell, Los Angeles, Calif.; Structural Engr., Rust Eng. Co., Pittsburgh, Pa.; Designer, Pressed Steel Car Co., McKees Rocks, Pa.

FORREST, CASWELL UNDERWOOD, Dallas, Tex. (Age 30) (RCA 3.5 RCM 1.0) March 1941 to March 1946, Structural Engr., U.S. Army, released with rank of Major.

GAFFNEY, CHARLES MALCOLM (Junior), San Antonio, Tex. (Age 35) (RCA 3.8) July 1942 to Jan. 1946 with U.S. Navy, finally as Eng. Officer; 130th NCB.

GILBERT, GEORGE DOUGLAS, Sacramento, Calif. (Age 38) (RCA 5.2) Feb. 1934 to date with California Bridge Dept., since Aug. 1942 as Asst. Bridge Engr.

GOEDJEN, MERLE HENRY, Chicago, Ill. (Age 37) (RCA 5.9 RCM 3.6) Nov. 1934 to Aug. 1943 and Dec. 1944 to date with Commonwealth Edison Co., at present as Engr.; in the interim with Corps of Engrs., U.S. Army.

GOODELL, FLOYD KENT, Chicago, Ill. (31) (RCA 3.3) June 1937 to July 1944 and April 1946 to date Junior Engr., American Bridge Co.; in the interim Lt. (jg), U.S. Navy.

GRAD, HOWARD, Washington, D.C. (Age 32) (RCA 2.6 RCM 7.5) Jan. 1946 to date member of firm, Frank Grad & Sons, Archts. and Engrs., Washington, D.C.; previously with U.S. Navy; with Tuller Constr. Co. and Villa Contr. Co., Red Bank, N.J.; with Ehret-Day Constr. Co., Asbury Park, N.J.

GRILLO, ODAIR (Junior), São Paulo, Brazil. (Age 35) (RCA 3.0) April 1944 to date Prof., Polytechnic School, Univ. of São Paulo; previously with Inst. for Technological Research of São Paulo.

HALL, HERBERT FRANKLIN, Santa Fe, N. Mex. (Age 43) (RCA 11.5 RCM 1.6) Jan. 1934 to May 1942 and Jan. 1944 to date with New Mexico Highway Dept., in the interim with Crocker & Ryan, Cons. Engrs.

HALL, WILLIAM HARVEY (Junior). (Age 36) (RCA 4.8) Sept. 1941 to Aug. 1944, Asst. Prof. of Civ. Eng., and Jan. 1946 to date Civ. Engr. Bldg. Supervision Sec., Oklahoma Agricultural and Mechanical Coll.; in the interim with USNR.

HAYNES, LAWRENCE MILWEE, Honolulu, Hawaii. (Age 36) (RCA 6.0) May 1930 to date with USED, since May 1944 as Engr. (Constr.) P-4, 2nd Field Area, Honolulu, Hawaii.

HECHTMAN, ROBERT AARON (Junior), Champaign, Ill. (Age 35) (RCA 1.1 RCM 3.3) 1945 to date, with Univ. of Illinois as Special Research Engr.; previously with Dravo Corporation, finally as Administrative Asst.

HILL, EARL EDWARD, Miles City, Mont. (Age 38) (RCA 7.6) Sept. 1929 and May 1945 to date with Montana Highway Dept., finally as Project Engr.; in the interim with CAA, Dept. of Commerce.

HILL, WALTER NORTH, Dallas, Tex. (Age 41) (RCA 5.6 RCM 5.6) April 1946 to date Senior Engr., City of Dallas, Tex.; previously Senior Engr., Magnolia Petroleum Co., Dallas; Texas Highway Dept.

HRONCICH, MARK JOSEPH, Freeport, N.Y. (Age 33) (RCA 7.6 RCM 1.0) Feb. 1940 to date Engr., American Gas & Elec. Service Corporation, New York City; previously Engr., Cayuga Constr. Corporation, New York City.

IRVIN, LESLIE ARTHUR (Junior), Venice, Calif. (Age 34) (RCA 3.9 RCM 1.8) March 1941 to April 1942 and Nov. 1945 to date Staff Engr., Donald R. Warren Co., Los Angeles, Calif.; in the interim Officer, CAC, U.S. Army.

JENNINGS, WILFRED ROBERT, Santa Cruz, Calif. (Age 34) (RCA 2.3 RCM 1.3) Jan. 1943 to date with City Engr. Office, Santa Cruz, since Aug. 1945 as Planning Engr., and Deputy City Engr.; previously Senior Eng. Aide, U.S. PRA, Alaskan Highway; Jun. Engr., California Dept. of Fish & Game.

JENSEN, CHARLES, Knoxville, Tenn. (Age 30) (RCA 12.6) Nov. 1933 to date with TVA, since Dec. 1941 as Associate Engr.

JOHANEK, JOHN ALTON (Junior), Berkeley, Calif. (Age 34) (RCA 6.9) Nov. 1945 to date Member of firm, J. Y. Long Co.; previously Senior Civ. Engr., East Bay Municipal Utility Dist., Oakland Calif.; Structural Eng. Designer, D. R. Warren Co., Los Angeles, Calif.

JOHNSON, HAMILTON KENDEL, Olympia, Wash. (Age 33) (RCA 6.3) March 1946 to date Chf. Engr., Pollution Control Comm., Olympia, Wash; previously Major, San. Corps, AAF; Associate Civ. Engr., Portland (Ore.) Dist. Army Engrs.

JORDAN, DONALD THOMAS, Sr., Chicago, Ill. (Age 32) (RCA 2.8 RCM 1.5) April 1941 to date Designer and Estimator, American Bridge Co., Chicago, Ill.

KEENAN, JACK ALLEN, Pasadena, Calif. (Age 31) (RCA 2.5 RCM 1.4) Feb. 1946 to date, Project Engr., Gen. Tire & Rubber Co., Pasadena, Calif.; previously with U.S. Army, finally as Major, Corps of Engrs., New Delhi, India; Planning Engr., Calif. Shipbuilding Corporation Los Angeles, Calif.; Engr., Wilshire Oil Co., Norwalk, Calif.

KETCHUM, DANIEL READING, Ft. Worth, Tex. (Age 36) (RCA 8.7 RCM 3.0) Oct. 1933 to date with U.S. Engrs., since July 1943 as Res. Engr., Ft. Worth Sub-Office.

KINDSVATER, CARL EDWARD (Junior), Atlanta, Ga. (Age 32) (RCA 3.0 RCM 2.3) Nov. 1945 to date Assoc. Prof., Georgia School of Technology previously Associate Hydr. Engr., U.S. Eng. Office, Little Rock, Ark.; Asst. Hydr. Eng., TVA.

KUENTZ, CARL LEE, (Junior), Dallas, Tex. (Age 31) (RCA 3.2) Aug. 1944 to April 1946 with USNR, since Oct. 1945 as Lt. (jg); previously Airways Engr. (P-3) and Asst. Airways Engr. (P-2), CAA.

LUTES, DAVID WALLACE (Junior), San Francisco, Calif. (Age 34) (RCA 6.5) Feb. 1946 to date Supt., W. C. Tait Co., San Francisco, Calif.; previously Lt., CEC, USNR; Office Engr., for City of San Diego, Calif.

MARTINEZ-SALAS, FRANCISCO JOSE, Caracas, Venezuela. (Age 33) (RCA 9.8) Nov. 1936 to date with Dept. of Public Works, Caracas, Venezuela, since Dec. 1945 as Chf. Engr., Port Div.

MASLAN, LEON (Junior), Kansas City, Mo. (Age 33) (RCA 6.1) Aug. 1942 to March 1946 with Corps of Engrs., U.S. Army, finally as Capt.; previously with U.S. Engrs.; with U.S.S.C.S.

MICHEL, HILBERT FREDERICK, Kansas City, Kans. (Age 33) (RCA 7.7) Aug. 1936 to date with War Dept., U.S. Engr. Office, since July 1945 as Structural and Mechanical Designer on work for dams.

MICHELS, RODOLFO, Jr., La Oroya, Peru. (Age 27) (RCA 3.6) Nov. 1945 to date Chf. Field Engr., Cerro de Pasco Corporation, La Oryo, Peru; previously with Anaconda Mining Co.; in private practice; with Bethlehem Steel Co.

This concrete arterial street in Grand Island, Neb. enhances property values because of its impressive neatness. Its light color simplifies night illumination—makes driving safer.

Clean, attractive concrete streets enhance a city's pride in its downtown business section. This concrete pavement in Wichita Falls, Texas, has carried traffic more than 25 years.

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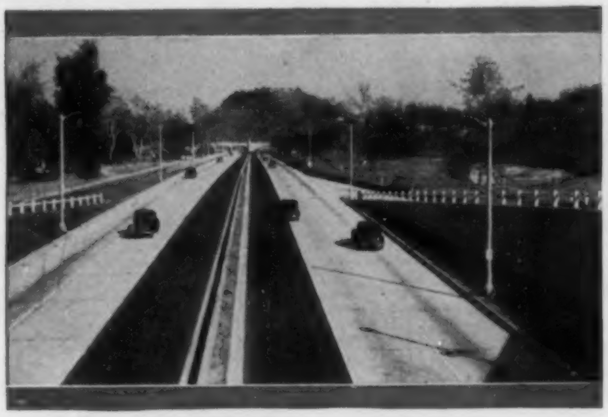

The concrete pavement on Arroyo Seco Parkway carries, without congestion, heavy traffic between the downtown sections of Los Angeles and Pasadena.

This concrete paved residential street in Augusta, Ga., has given more than 25 years of service. It is still in excellent condition as shown by recent picture.

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MORGAN, CLIFFORD LEON (Junior), Denver, Colo. (Age 32) (RCA 4.3 RCM 3.7) Feb. 1946 to date, San. Engr., Crocker & Ryan, Denver, Colo.; previously 1st Lt. and Capt., San. Corps, U.S. Army; Constr. Engr., Eastern Pipeline Co., Kansas City, Mo.; Asst. Engr., Whitman, Requardt & Smith, Baltimore, Md.

MUTTERER, WILLIAM ELMAR (Junior), Ridgefield Park, N.J. (Age 34) (RCA 2.9) Aug. 1943 to Feb. 1946 Corporal, U.S. Army Engr., Construction Bn.; previously Estimating Engr., The Foundation Co., New York City; Asst. Construction Manager & Supt., Cross Roads, Inc., Packanack Lake, N.J.

NISHKIAN, BYRON LEON (Junior), San Francisco, Calif. (Age 30) (RCA 3.8) May to Sept. 1940, June 1941 to Sept. 1942 and Oct. 1945 to date with L. H. Nishkian; in the interim with U.S. Army; on Timber Testing Program ASCA.

NORTH, ERNEST CULVER, Baltimore, Md. (Age 42) (RCA 11.6 RCM 3.0) May 1941 to date with Whitman, Requardt & Smith, at present as Valuation Engr.; previously with Cummins Constr. Corporation.

NOTH, MELVIN JULIUS, West De Pere, Wis. (Age 34) (RCA 2.7 RCM 1.2) June 1942 to Dec. 1945 with Corps of Engr., U.S. Army; previously with Walsh & Driscol Co., New York City.

PALANGE, RALPH CARMEN (Junior), San Juan, Puerto Rico. (Age 34) (RCA 4.0) Aug. 1940 to date with USPHS, since Dec. 1945 as Major, Office of Surplus Property Utilization.

PARKER, CHESTER MERWIN, Hollis, N.Y. (Age 35) (RCA 2.9) Aug. 1945 to date Structural Designer, Hardesty & Hanover, New York City; previously commissioned officer, U.S. Air Force; with Waddell & Hardesty, New York City.

PARSONS, CARL ORRIN, Concord, N.H. (Age 37) (RCA 9.9) July 1942 to date Field Engr., Lane Constr. Corporation, Meriden, Conn.; previously with SCS, finally Dist. Engr.; with U.S. Foust Service.

PETERSEN, HARRY GEORGE (Junior), San Leandro, Calif. (Age 35) (SP 3.5) Sept. to Dec. 1942, Gen. Asst. with George Petersen, and June 1943 to date member of firm, George Petersen & Son, San Leandro, Calif.; in the interim with U.S. Navy, Public Works Dept.; previously with U.S. Army Engrs.

POU, JAMES FRANCIS (Junior), Winston-Salem, N.C. (Age 32) (RCA 5.0 RCM 2.2) Feb. 1946 to date Service Engr., Penn-Dixie Corporation; previously with CEC, U.S. Navy, finally as Lieut. (jg); with TVA.

PURVIS, VIRGIL OTHO, Jr., Little Rock, Ark. (Age 30) (RCA 4.6) June 1942 to date Associate, Marion L. Crist & Associates, Little Rock; previously Jun. Engr., Little Rock, Ark., Engr. Dist.

RAMBERG, EIVIND GUNNAR FRANK, Brooklyn, N.Y. (Age 35) (RCA 3.8) Sept. 1942 to March 1944 and Oct 1945 to date Asst. Prof. of Physics, Newark, N.J. Coll. of Eng.; in the interim Eng. Supervisor, Otis Elevator Co., New York City; previously Instructor in Civ. Eng., Cooper Union.

RANSOM, MILAN WIGGINS, Burbank, Calif. (Age 36) (RCA 8.5) Oct. 1934 to July 1944 and Feb. 1946 to date with Los Angeles County Flood Control, finally as Eng. Aide; in the interim Lt. (j.g.) and Lt., USNR.

REESE, FRELLSEN, Tallulah, La. (Age 27) (RCA 2.8 RCM 1.2) Feb. 1946 to date Res. Engr., Dept. of Public Works, Baton Rouge, La.; previously with U.S. Army, finally as Major.

REICHMANN, ALBERT FERDINAND, (Junior), Chicago, Ill. (Age 31) (RCA 6.3) June 1936 to Aug. 1942 and Nov. 1945 to date with Bates & Rogers Constr. Corporation, Chicago, Ill.; in the interim, Major, U.S. AAF.

ROESSLE, EVERETT GRUNER, New Orleans, La. (Age 44) (RCA 7.5 RCM 2.0) Oct. 1936 to Dec. 1942 and Oct. 1945 to date with G. P. Rice, Cons. Engs., New Orleans, since Oct. 1945 as Office Engr. and Structural Designer; in the interim, Civ. Engr., War Dept., U.S. Eng. Office, Keesler Field, Miss.

ROGUS, CASIMIR ANDREW, Bayside, N.Y. (Age 41) (RCA 7.8 RCM 6.3) June 1928 to date with City of New York, since March 1943 as Chf., Structural Sec., Dept. of Public Works Bureau of Sewage Disposal.

RUCKER, ERLE TALIAFERRO, Richmond, Va. (Age 38) (RCA 8.8 RCM 1.3) July 1928 to date with Chesapeake & Ohio Ry., since March 1945 as Asst. Div. Engr.

SACHERS, GUSTAVE ERIC, Roanoke, Va. (Age 50) (RCA 15.6 RCM 4.5) May 1942 to May 1943, Sept. 1944 to Feb. 1945 and Feb. 1946 to date private practice, Roanoke, Va.; in the interim with U.S. Civ. Service Comm., Winston-Salem, N.C.; 1st Lt., Coast Guard, U.S. Army.

SCHIFF, LEONARD (Junior), Los Angeles, Calif. (Age 34) (RCA 5.0) Feb. 1934 to May 1943 and Feb. 1946 to date with U.S. Dept. of Agriculture, after July 1941 as Hydr. Engr. (P-4); in the interim Lt. (j.g.) and Lt., U.S. Navy.

SOLANO, ULISES, Easthampton, Mass. (Age 47) (RCA 3.8 RCM 17.0) June 1944 to date Superv. Engr., RFC, Boston, Mass.; previously Associate Engr., War Dept., U.S. Army Engrs.; Work Project Supt., Dept. of Housing and Bldgs., New York City.

SWITZER, PHILIP HERMAN, Moline, Ill. (Age 35) (RCA 4.0 RCM 2.0) Jan. 1946 to date, Associate Civ. Engr. with U.S. Engr. Office, Rock Island, Ill.; previously Capt., U.S. Army, Corps of Engrs.

SWORD, STANFORD HAROLD, Glenolden, Pa. (Age 41) (RCA 9.2) March 1946 to date, Civ. Engr., Construction Div. of Veterans Admin., Philadelphia, Pa.; previously Lt. Comdr. USNR, CEC.

VANDENBERG, JOHN LOYD (Junior), Little Rock, Ark. (Age 36) (RCA 4.2) April 1946 to date Asst. Highway Eng., PRA, FWA; previously Supervisor of Constr., Foreman School, Fort Belvoir, Va.; Co. Commdr. and Engr. Officer, 43d Engrs. (Constr. Bn.); with U.S. FSA.

WALKER, CHARLES RICE (Junior), Omaha, Neb. (Age 36) (RCA 3.9 RCM 1.0) March 1946 to date Engr., P-4, U.S. Engrs., Omaha, Neb.; previously Major, U.S. Army; Asst. Materials Engr., Cherokee Dam, TVA.

WEISMAN, ROBERT LEON (Junior), Baltimore, Md. (Age 32) (RCA 6.4) Oct. 1945 to date, Draftsman & Field Engr., Hall, Turpin & Wachter, Architect-Engrs.; previously Draftsman and Field Engr., Perring & Remington, Baltimore, Md.

WHEELER, WILLIAM THORNTON (Junior), Pasadena, Calif. (Age 34) (RCA 13.0) March 1946 to date Structural Engr. (private practice), Los Angeles, Calif.; previously Asst. Chf. Engr., Summerbell Roof Structures, Los Angeles; with U.S. Engrs., Salt Lake and San Francisco Dists.

WHITE, ORMOND CHARLES CALVERT, Perth, Australia. (Age 37) (RCA 11.6 RCM 1.3) 1938 to date with Govt. of Australia, since 1943 as Senior Engr., Dept. of Works, Western, Australia.

WILLETS, DAVID BEAL, Pasadena, Calif. (Age 39) (RCA 2.0 RCM 2.8) Dec. 1945 to date, Asst. Hydr. Engr., Div. Water Resources, Calif.; previ- Col., Ordnance Dept., U.S. Army.

WU, HANG-MIEN (Junior), Shanghai, China. (Age 34) (RCA 5.9 RCM 0.8) Sept. 1945 to date Chf., First Dept., Bureau of Public Utilities, Shanghai Municipal Govt.; previously with Eng. Dept., B.P.W., Chungking, China; Dept. of San. Eng., National Inst. of Health, Chungking.

APPLYING FOR JUNIOR

ANDERSON, ROBERT ARCHIBALD KENNETH, Seattle, Wash. (Age 29) July 1939 to March 1946 with Corps of Engrs., U.S. Army, finally as Capt.

BALDWIN, FRANCIS COOPER, Richmond, Va. (Age 27) (RCA 1.3) Dec. 1945 to date, Asst. Buildings Engr., Chesapeake & Potomac Telephone Co. of Virginia; previously with U.S. Army Engrs., finally as Chf. Engr., Control Officer, Western Base Sec. and Channel Base Sec.

CHILCOAT, RALPH LEROY, Larchmont, N.Y. (Age 30) (RCA 2.0) Sept. 1945 to date Asst. Village Eng. Draftsman, Durez Plastics & Chemicals, Inc., No. Tonawanda, N.Y.; with Govt., District of Columbia.

CRISPEN, ROBERT ELWOOD, Bethlehem, Pa. (Age 30) Feb. 1946 to date Instructor, Lehigh Univ.; previously Lt. Col., Field Artillery, U.S. Army.

CROW, JOHN PAUL, Montgomery, Ala. (Age 24) Jan. 1946 to date, Sales Engr., Kershaw Co., Montgomery, Alabama; previously Officer, U.S. AAF and Army Corps of Engrs.

EKIZIAN, HARRY, JR., New York, N.Y. (Age 24) (RCA 1.3) March 1943 to April 1946 U.S. Army Corps of Engrs. After March 1945 Structural Eng., National Advisory Committee for Aeronautics; previously Party Chf., Arthur A. Johnson S. Necaro Co., Long Island City, N.Y.

FIDELMAN, SAUL, Minneapolis, Minn. (Age 29) Dec. 1945 to date Engr., U.S. Engrs.; previously in Service of U.S.; with Minnesota Highway Dept.

GRANGER, DICK BUCKINGHAM, Dallas, Tex. (Age 28) Dec. 6, 1945 to date Soils Inspector, Rollins and Forrest Cons. Engrs., Dallas, Tex.; previously Rodman, Texas Highway Dept., Austin, Tex.

LOH, KUO-LIANG, Hangchow, China. (Age 28) Feb. 1946 to date student, Graduate School, Univ. of Illinois; previously with FEA and Chinese Govt.

MACKENNA, ARTURO, York, Pa. (Age 27) (RCA 3.7) Oct. 1945 to date Inspecting Engr., Corporacion de Fomento Chile, New York City; previously with Empresa Nacional de Electricidad, Chile.

MAGNUSON, GORDON STEWART, Beverly Hills, Calif. (Age 26) (RCA 1.1) Sept. 1943 to April 1946 with CEC, USNR, after May 1945 as Lt. (jg.); previously with Chicago Bridge & Iron Co.

O'MALLEY, WILLIAM PATRICK, Pittsburgh, Pa. (Age 26) (RCA 2.0) Nov. 1945 to date Designer, Hunting, Davis & Dunnells, Pittsburgh, Pa.; previously with Douglas Aircraft Co.

SCHARNBERG, ROBERT LEE, Everly, Iowa. (Age 26) Jan. 1946 to date Res. Engr., Stanley Eng. Co., Muscatine, Iowa; previously with USNR, finally as Lt.

SUTER, BRUCE HENRY, Birmingham, Ala. (Age 24) (RCA 3.1) Jan. 1946 to date Engr., South-Eastern Underwriters Association; previously Capt., Corps of Engrs., U.S. Army.

WILLIAMS, GEOFFREY MILSON JOHN, Hounslow West Middlesex, England. (Age 23) Dec. 1945 to date Jun. Civ. Engr., Scott & Wilson, Cons. Engrs., London, England; previously Experimental Officer, Ministry of Supply, Radar Research Establishment.

1944 GRADUATE

UNIV. OF UTAH
(B.S. in C.E.)

Age

LINFORD, PRESTON DEE (24)

1945 GRADUATES

UNIV. OF CALIF.
(B.S. in C.E.)

BRUNET, EDMUND ALBERT (21)

UNIV. OF ILL.
(B.S. in C.E.)

FORCKING, ROBERT JOHN (22)

1946 GRADUATES

CALIF. INST. TECH.
(B.S. in C.E.)

STEPHENSON, ELLIOTT OWEN (27)

UNIV. OF CALIF.
(B.S. in C.E.)

GLENN, ROBERT FRANCIS (21)
GONNASON, WARREN CUMMINS (21)
NORDSTROM, ROBERT DALE (25)
PAGE, JOHN MORGAN (30)
SERR, EUGENE FRANK, 3D (21)
SHERARD, JAMES LEWIS (20)
SIMPSON, DON GAYLORD (22)
SKARIN, PHILIP HELGE (22)
SOMERVILLE, JOY ELENWOOD (21)

UNIV. OF MICH.
(B.S. in C.E.)

BENTZ, WARREN WORTHINGTON (20)
CHATFIELD, ROBERT BRUCE WALLACE (21)
DYSON, FREDERIC ECKHART, JR. (20)
HESSEE, CLAUDE THOMAS (21)
MOOTE, PAUL ALLEN (21)
PEDDY, JACK ERNEST (21)
ROYCE, ROBERT FREDRICK (23)
SNYDER, STUART ANDREW (22)
SPEVAK, SAMUEL MORRIS (20)
WICKEY, JOHN VICTOR (21)

KANS. STATE COLL.
(B.S. in C.E.)

HOOVER, LEONARD RALPH (25)

CLEMSON A & M COLL.
(B.S. in C.E.)

JONES, HENRY CHAPMAN (23)
PAYNE, HAROLD SIMPSON (24)

ILL. INST. TECH.
(B.S. in C.E.)

CANNON, WILLIAM WARRING (21)

UNIV. OF KANS.
(B.S. in C.E.)

KELLER, CHARLES WALTER, IV (20)

UNIV. OF MD.
(B.S. in C.E.)

ZEIGLER, EDWARD JAMES (23)

PURDUE UNIV.
(B.S. in C.E.)

CLARK, JOHN WOOD (24)

S.DAK. STATE COLL.
(B.S. in C.E.)

MILLER, GEORGE ERWIN (28)

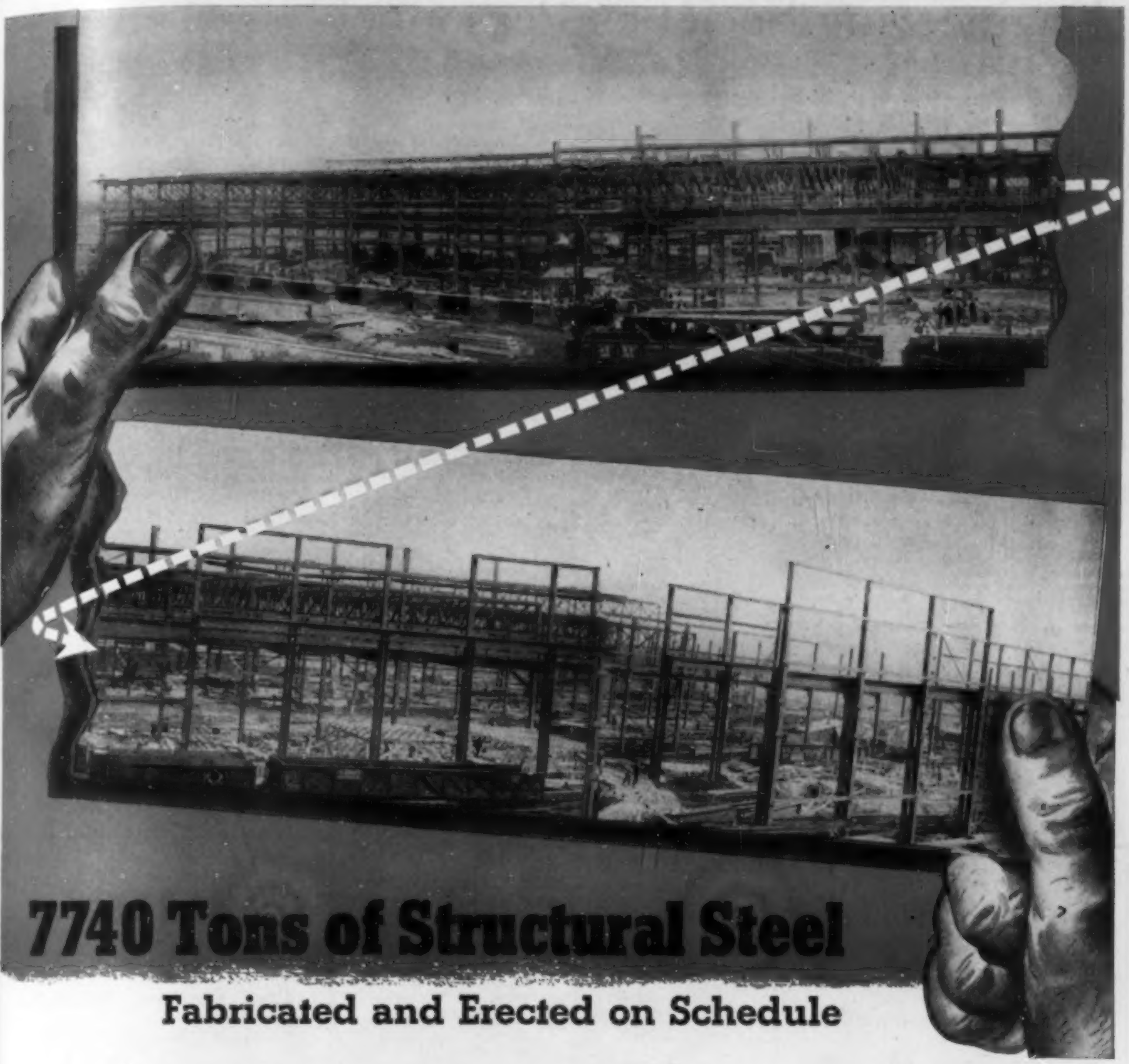
UNIV. OF TEX.
(B.S. in C.E.)

HUBBARD, CHARLES COOPER (25)

UNIV. OF UTAH
(B.S. in C.E.)

BAKER, STANLEY JAY ([illegible])

The Board of Direction will consider the applications in this list not less than thirty days after the date of issue.



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A weekly bulletin of engineering positions open is available to members of the cooperating societies at a subscription of $3 per quarter or $10 per annum, payable in advance.

Men Available

Civil Engineer; Assoc. M. ASCE; 35; married; B.S.C.E. degree; licensed C.E., California; Commander, Civil Engineer Corps. Six years' Naval experience on administration of construction contracts, housing, roads, buildings, concrete structures, utilities; public works officer at large station. Desire position as construction, municipal, or maintenance engineer, preferably on West Coast. Available July 15, 1946. C-285.

Civil Engineer; Jun. ASCE; age 29; M. of C.E.; specialization in structural engineering; 5 years varied experience, including building and massive reinforced concrete design; 3 years as captain in U.S. Public Health Service as consultant on refuse and sewage disposal. Desire permanent type of position in New York City; available immediately. C-286.

Sanitary Engineer; Jun. ASCE; 27; single; B.S., Lehigh University, 1939, with honors; graduate study at New York University. Until recently sanitary engineer with Navy, Superintending Civil Engineer as Lt. (CEC) USNR; 2 years experience in hydraulic and airfield design with U.S. Engineers. Experience in surveying and municipal engineering, also with state Board of Health. C-287.

Civil Engineer; Jun. ASCE; age 25; single; graduate of Univ. of Connecticut, 1943; B.S.C.E.; 2½ years service with U.S. Navy as Engineering Officer aboard an LSM. Desire position with consulting engineering or contracting firm located in New England. Available August 1946. C-288.

Positions Available

Building Maintenance Engineer, 30–40, with experience in the construction and maintenance of commercial buildings, to lay out mechanical and electrical equipment, building alterations and additions, write up specifications, secure estimates, and handle correspondence. Salary, $4,200 a year. Location, New York, N.Y. W-7185.

Civil Engineer, 28–38, experienced in office and field work and capable of handling medium-size construction projects, to estimate, lay out, and supervise office and field work or act as liaison between office and field with privilege of learning the business. Some traveling. Location, New York, N.Y. W-7195.

Structural Designers and Draftsmen for established firm of consulting engineers. Experience required on steel and concrete bridges. Permanent positions for qualified men. Write giving full details of education and experience. Location, New York, N.Y. W-7200.

Project Engineer, 40–50, to take charge of the field construction of a large power plant. Should have had charge of a similar project on Eastern Seaboard, including docks and waterfront foundations and structures. Salary, $10,000 a year. Location, New York Metropolitan Area. W-7203.

Architectural Draftsmen, 25–40, with varied experience, to work from preliminary sketches, prepare working drawings, and some field supervision along educational, commercial, and residential lines. Salary, $3,900 a year, plus overtime. Location, upstate New York. W-7210.

Sales Engineer, 25–30, civil graduate, preferably with some practical experience in cement and concrete. Must be willing to travel. Three- to four-month training period. Salary, $2,600 a year, plus all traveling expenses. Headquarters, northern New Jersey. W-7218.

Structural Steel Designer, civil graduate, with 5 to 10 years' industrial construction experience, to design supports for concrete storage tanks, heavy girders, and columns, etc. Must be neat and accurate draftsman. Salary, $5,000–$6,000 a year. Location, New York, N.Y. W-7240.

Party Chief with 10 to 15 years' experience in land surveying and general municipal engineering, to take responsible charge of town work. Salary open. Location, northern New Jersey. W-7251.

Instructor or Assistant Professor, civil graduate, to teach surveying, mechanics of materials, reinforced concrete, and highway transportation. Salary, $2,400–$3,000 a year. Location, New York, N.Y. W-7261.

Assistant Professors. (*a*) Assistant or Associate Professor, civil graduate, to teach soil mechanics and foundation courses and to assist in courses in mechanics and surveying. Salary, $2,400–$3,900 for nine months. (*b*) Instructor or Assistant Professor, engineering graduate, to teach mechanics, surveying, and testing materials. Salary, $2,400–$3,240 for nine months. Location, Texas. W-7270.

Structural Engineer to take charge of design of all concrete and steel for industrial building construction. Location, Pennsylvania. W-7276.

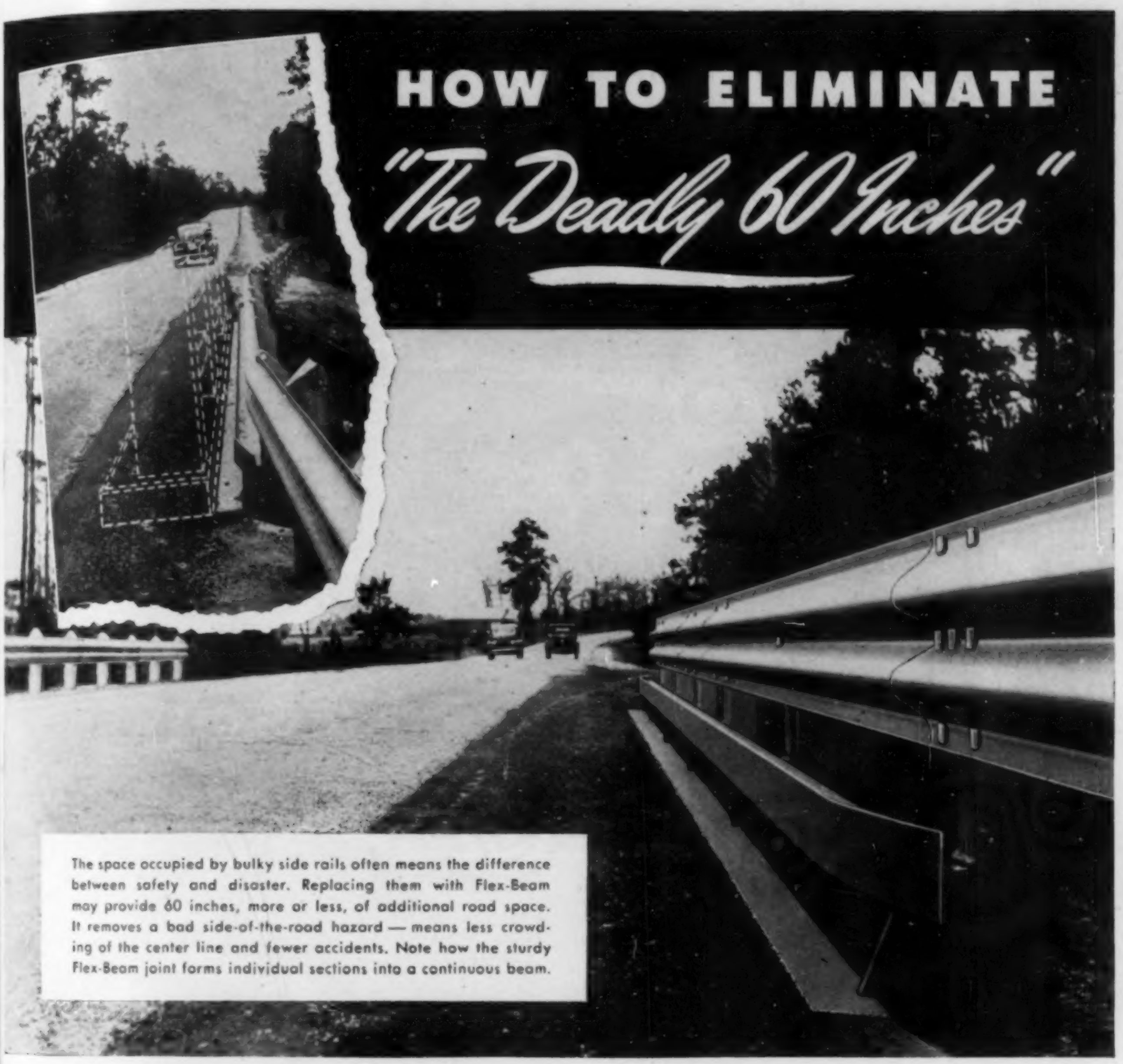
Sales Engineer, civil graduate, with concrete and masonry construction experience, to call on architects, engineers, contractors, etc., in connection with sale of waterproofing product. Salary, $2,400–$3,000 a year. Territory, New Jersey and Pennsylvania. Headquarters, northern New Jersey. W-7279.

Civil Engineer, preferably with structural steel erection experience, to run lines and level, do time-keeping and other engineering duties on steel construction work. Single man preferred. Salary, $2,400–$3,000 a year. Traveling in Eastern states. Headquarters, New York, N.Y. W-7288.

Structural Designer capable of designing small concrete and steel bridges. Should know something about highway design, etc. Permanent. Salary, $4,500 a year. Location, Florida. W-7305.

Instructors, 27–30, civil graduates, to teach strength of materials, sanitary engineering, structures, or surveying. Salaries, $2,950 for nine months. Location, New York, N.Y. W-7307.

Engineers. (*a*) Project Manager with housing experience, to take general charge of erection and installation of demountable semi-permanent veterans' operation. (*b*) Construction Superin-



The space occupied by bulky side rails often means the difference between safety and disaster. Replacing them with Flex-Beam may provide 60 inches, more or less, of additional road space. It removes a bad side-of-the-road hazard — means less crowding of the center line and fewer accidents. Note how the sturdy Flex-Beam joint forms individual sections into a continuous beam.

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tendent to supervise field layout, foundations, erection, and installation of all facilities. Positions temporary—about three months. Salaries, (a) $6,500–$7,800; (b) $5,200–$6,500 a year. Location, New York, N.Y. W-7313.

CIVIL ENGINEERS, preferably with some experience in concrete, to contact clients and to assist in solving customers' problems. Some traveling. Salary, $3,000 up, a year. Headquarters, Pennsylvania. W-7317.

ENGINEER with experience in field and office work on highway construction. Must be accomplished instrumentman and capable of acting as chief of party and inspector. Will consider recent graduate with thorough knowledge of surveying. Location, south-central New York State. W-7322.

CIVIL ENGINEER with construction and plant experience who can apply line-production methods to a large construction job. Write giving full details. Location, Washington, D.C. W-7029.

ENGINEERS. (a) Cost Engineer, 35–45, with construction experience covering labor, materials, and equipment, for field assignment on heavy construction. Location, Venezuela and Colombia. Salary, $4,800 a year plus subsistence. (b) Senior Cost Engineer, 35–50, with heavy construction experience covering cost control, cost analysis, etc., to supervise job costs and estimates in general office. Salary, $4,800 a year. Location, New York, N.Y. W-7220.

ENGINEERS. (a) Civil Engineer to take charge of seven or eight survey parties and make a complete topographical map of an island in the Pacific. Should have had geodetic surveying experience. Salary, $8,400–$9,500 a year. Duration, 18 months. (b) Water Supply Engineer required to make a study to recommend best solutions to water supply problems. (c) Sanitary Engineer to make surveys and study and preliminary design of sewage-treatment and disposal plant. Salaries, $7,500–$8,500 a year. Location, foreign. W-7266. Rewritten.

Current Periodical Literature

Abstracts of Magazine Articles on Civil Engineering Subjects

Selected items for the current Civil Engineering Group of the Engineering Index Service, 29 West 39th Street, New York, N.Y. Every article indexed is on file and may be borrowed from the Engineering Societies Library. Photoprints will be supplied at the cost of reproduction, 25 cents per page to members of the Founder Societies (30 cents to all others), plus postage.

BRIDGES

RAILROAD, AUSTRALIA. New Railway Bridge Over Hawkesbury River. *Commonwealth Engr.*, vol. 33, no. 7, Feb. 1, 1946, pp. 221–223. General design data on new Hawkesbury River bridge, New South Wales, now under construction; of steel truss design, bridge consists of eight spans measuring from 147 to 447 ft long, pedestal supported; total length of completed structure to be 2,729 ft, and width 38 ft.

STEEL, BEARINGS. Bridge Bearings Sealed to Stop Pier Concrete Spalling Due to Leaking and Freezing, W. J. LaFleur. *Construction Methods*, vol. 28, no. 3, Mar. 1946, pp. 86–89, 167–168, 170, 172, and 174–175. Illustrated description of damages caused by water and frost to bearings of Lake Champlain steel bridge near Port Henry, N.Y.; corrective measures consist of sealing of all bearings and restoring damaged concrete surfaces.

SUSPENSION. Cable-Stiffened Suspension Bridge Developed Through Engineer Board Research, W. G. Grove. *Eng. News-Rec.*, vol. 136, no. 10, Mar. 7, 1946, pp. 347–350. Description of investigations made at Ft. Belvoir of model bridge design, consisting of cable-stiffened suspension span, in which structural steel stiffening trusses or girders conventionally used are replaced by diagonals and cables of steel wire rope; features of new design include unusual rigidity and weight saving without wave action under traffic; structural details.

SUSPENSION, TACOMA, WASH. Construction Features of Tacoma Narrows Bridge. *Pac. Bldr. & Engr.*, vol. 52, no. 1, Jan. 1946, pp. 44–48. Article describes design aspects of new 5,979-ft Tacoma Narrows Bridge as compared with characteristics of original structure that failed; features include higher towers, larger cables, lightweight concrete deck, reconstructed cable anchorages and concrete pedestals, use of tower outriggers, and vastly increased moment of inertia.

VIADUCTS, REPAIR. Reconstruction of Longeray Viaduct, L. Turner. *Concrete & Constr. Eng.*, vol. 41, no. 3, Mar. 1946, pp. 62–68. Illustrated description of reconstruction of 1,200-ft single track railroad viaduct over Rhone River at Longeray, France; four steel spans, from approximately 174 to 228 ft destroyed during war, were replaced by reinforced concrete arches; details of design and construction.

BUILDINGS

ORDNANCE PLANTS. How 40 Contractors Built Hanford Atom-Smashing Plant, F. T. Matthias. *Pac. Bldr. & Engr.*, vol. 52, no. 2, Feb. 1946, pp. 44–49, and 93. Illustrated description of vast plant in so far as construction features are no military secret; site of plant is along Columbia River at Hanford, Wash.; quarters for more than 50,000 persons were provided at site; six major industrial plants representing total of $350,000,000; 25,000,000 cu yd had to be excavated, and approximately 800,000 cu yd concrete ahd to be placed.

CITY AND REGIONAL PLANNING

GREAT BRITAIN. Human Needs in Planning. *Roy. Inst. Brit. Architects—J.*, vol. 53, no. 4, Feb. 1946, pp. 126–128. Extracts from addresses at conference of RIBA; housing requirements and population studies; grouping of homes in relation to work places and institutions; social function of towns and their place in region; social relationships and territorial grouping in towns and countryside.

GREAT BRITAIN. Planning of Residential Areas, G. Stephenson. *Roy. Inst. Brit. Architects—J.*, vol. 63, no. 4, Feb. 1946, pp. 107–112, (discussion) 113–116. Paper gives brief review of past residential building in England and examines some theories of residential area planning at home and abroad; satellite towns as solution to problem of decentralization and decongestion; example of housing planning in Amsterdam, Netherlands, as illustrative of desirable practice; organization of effective planning and development department.

CONCRETE

BEAMS AND GIRDERS. Diagram for Calculating Reinforced Concrete Rectangular Beams, B. Veliki. *Concrete & Constr. Eng.*, vol. 41, no. 1, Jan 1946, pp. 3–9. Formulas and charts based on relation between neutral axis depth, stresses, proportion of tensile steel, and modular ratio; application to singly and doubly reinforced rectangular beams; numerical examples; charts.

CEMENT ADMIXTURES, CALCIUM CHLORIDE. Calcium Chloride in Concreting. *Calcium Chloride Assn.—Bul. No. 28*, 1945, 64 pp. Influence of calcium chloride on portland-cement concrete discussed; results as to stiffening, finishing, strength, weather protection, uniform curing, workability, etc., are favorable; various methods of adding calcium chloride to concrete are described and data on practical experience presented; technical abstracts, references, illustrations, and charts give proof of favorable qualities; suggestions for standard specifications are made.

CONSTRUCTION. American Concrete Institute Discusses Pre-casting, Pre-stressing, Entrained Air. *Eng. News-Rec.*, vol. 136, no. 12, Mar. 21, 1946, pp. 427–429. Brief review of some of topics discussed at 1946 meeting of American Concrete Institute, covering developments in concrete design and construction during war years; cement dispersion; retrained air in concrete, and performance reports; panel heating problems; prestressing of floating structures; innovations in construction; effects of A-bombs.

CONSTRUCTION FORMS. Lining Gives Smooth Concrete Finish. *Western Construction News*, vol. 21, no. 1, Jan. 1946, pp. 93–94. Use of Hydron sheet absorptive lining for concrete forms produces smooth surface free of blemishes, pits, and streaks; article describes use of material in synthetic rubber-plant project calling for smooth surface concrete separator structures; method is claimed to case-harden concrete to depth of at least 1 in.

CONSTRUCTION, PRE-STRESSING. Shrinkage and Plastic Flow of Pre-Stressed Concrete, H. R. Staley and D. Peabody, Jr. *Am. Concrete Inst.—J.*, vol. 17, no. 3, Jan. 1946, pp. 229–243. Description of tests on pipes, tanks, and columns; results reveal that moderate pre-stresses of 30,000 to 35,000 lb per sq in. do not fulfill object of prestressing since shrinkage and flow reduce prestress; employment of high-strength steel wires pre-stressed to 100,000 or 150,000 lb per sq in. recommended since reduction of 20,000 to 30,000 lb per sq in. due to shrinkage and flow still leaves satisfactory pre-stress.

DISINTEGRATION. Concrete Durability Highlights NRMCA. *Concrete*, vol. 54, no. 3, Mar. 1946, pp. 14–15, 20, 22, 24, and 26. Report on survey concerning highway structures of concrete in Wyoming, Oregon, Washington, and California, F. H. Jackson. Effect of gypsum contents in cement and of coarse aggregates on durability of concrete, S. Walker.

DRYDOCKS. Large Graving Dock in Australia. *Concrete & Constr. Eng.*, vol. 41, no. 2, Feb. 1946, pp. 43–48. Illustrated description of Captain Cook graving dock at Sydney, Australia; technical details of excavation, concrete walls, floor, pumping plant, operation, etc.

HOUSES. British Build Poured-Concrete Homes to Speed Solution of Housing Shortage. *Eng. News-Rec.* (News Issue), vol. 136, no. 1, Jan. 3, 1946, p. 5. Note on British method of building "Wimpey" two-family houses of poured concrete by use of special forms eliminating much skilled labor, saving erection time, and utilizing existing materials.

INDUSTRIAL PLANTS. Atomic Bomb Grew Within Concrete Walls. *Concrete*, vol. 54, no. 2, Feb. 1946, pp. 10–11 and 24. Illustrated description of Hanford Engineer Works built for processing of raw materials for atomic bombs; magnitude of project, distances between buildings, isolated location of site, time element, high quality of construction are some of abnormal conditions of structure; data on materials supply for 780 thousand cubic yards of concrete and 1½ million concrete blocks are presented; concrete plants were equipped with belt conveyors and pumpcrete machines.

LIGHT WEIGHT. Aluminum-Treated Concrete Cuts Building Costs, J. G. Wurtz, Jr. *Construction Methods*, vol. 28, no. 3, Mar. 1946, pp. 94–95, 158, 160, 162, and 163. Light-weight expanded

concrete is made by addition of aluminum powder to mix, which reacts in same manner as bread dough to yeast; such concrete may be field cast in place or used as pre-cast slabs; besides reduction of weight, expanded concrete has unusual sound-deadening properties; data on mixing, use, and properties; illustrations.

LIGHT WEIGHT. New Lightweight Aggregate from Fly Ash, R. F. Leftwich. *Concrete*, vol. 54, no. 1, Jan. 1946, pp. 14–15 and 39. Illustrated description of plant for manufacture of light-weight aggregate of fly ash for concrete masonry units in the Bronx, N.Y.; data on material, operating process, machines, and equipment given.

PIPE. Pre-stressed Concrete Pipe Details Are Explained, F. F. Longley. *Water Works Eng.*, vol. 99, no. 6, Mar. 20, 1946, pp. 291, 304–305. Description of recent improvements in making concrete pipes; lining steel pipe with concrete; pros and cons on pre-stressing; economy and additional elastic qualities of pre-stressed concrete pipes; chart presents typical stress diagram of pre-stressed pipe.

READY-MIXED CONCRETE PLANTS. Tennessee Plant Furnishes Concrete for Atom Bomb Project, J. H. Dixey. *Pit & Quarry*, vol. 38, no. 7, Jan. 1946, pp. 171–173. Description of plants built to supply ready-mixed concrete to Clinton Engineer Works, Oak Ridge, Tenn.; larger of two plants averaged production of 225 cu yd of concrete per hour, while total delivered by both was about 500,000 cu yd.

ROADS AND STREETS. Joints and Cracks in Concrete Pavements. *Pub. Roads*, vol. 24, no. 7, Jan.-Feb.-Mar. 1946, pp. 179–205. Study by Michigan State Highway Dept. and Pub. Roads Administration concerning conditions of joints in concrete pavements; general information on pavement slabs; measurement of typical faults; data on wheel loads; average slab lengths of plain and reinforced pavements compared; faulting at transverse cracks; significance of latter near expansion joints; causes of infiltration cracks; load transfer at joints desirable; illustrations, tables, charts. Bibliography.

ROCK PRODUCTS, WISCONSIN. Operating Trends in Rock Products Industry, H. B. Swanson and N. C. Rockwood. *Rock Products*, vol. 48, no. 12, Dec. 1945, pp. 106–118. Review of geology of state, material specifications for highways, typical aggregates operations.

ROOFS. Concrete Shell Roofs with Flexible Moulds, K. Billig. *Instn. Civ. Engrs.—J.*, vol. 25, no. 3, Jan. 1946, pp. 228–231. Illustrated description of flexible molds consisting of fine and dense jute fabric stretched over steel skeleton and fixed to it so as to form tight skin of exact shape of shell; other type uses high tensile, pre-stressed wires closely spaced, with fine wire mesh laid over and attached to them; data on costs of shell structures with flexible molds listed in table.

STRESSES. Stress Strain Relation of Concrete, A. C. Vivian. *Structural Engr.*, vol. 24, no. 1, Jan. 1946, pp. 42–53. Paper describes behavior of concrete in tension and compression; incompatibilities of mathematical principles and orthodox views are cited on following: that longitudinal strain in beam is proportional to neutral axis distance, that total tension equals and opposes total bending compression, that couple of out-of-balance tension and compression equals and opposes bending moment, that strain alters shape, not volume. Bibliography.

DAMS

CONCRETE, CHINA. China Plans Unprecedented Dam for Power, Irrigation and Navigation. *Eng. News-Rec.* (News Issue), vol. 136, no. 9, Feb. 28, 1946, pp. 310–311. Illustrations and brief notes on proposed 750-ft-high Yangtze River dam near Ichang, China, and power plant and navigation facilities, estimated to cost about a billion dollars, and require 15 million cu yd concrete; output of over 10$^1/_2$ million kw anticipated, more than thrice combined capacity of Coulee, Shasta, and Boulder dams; unusual means planned of getting ships past dam via tunnel.

HYDRAULIC GATES. Vibration Damage to Spillway Gates. *Eng. News-Rec.*, vol. 136, no. 12, Mar. 21, 1946, pp. 420–421. Description of damage done to vertical-lift gates of Bonneville Dam spillway due to force exerted by water surging through partly opened gates, and resultant vibration and hammering; remedial measures cited, including stiffening of assembly, and use of instruments to observe pressure changes.

FLOOD CONTROL

CALIFORNIA. Flood Control Contractors Beat California Rains. *Construction Methods*, vol. 28, no. 2, Feb. 1946, pp. 88–90. Illustrated description of measures to ensure railroad service between San Bernardino, Calif., and West Coast points in Southern California, regardless of seasonal rains; data on construction of Lytle and El Cajon Creeks flood-control project.

CALIFORNIA. Water Conservation—Ventura River Flood Control Plan, E. L. Clark. *Western*

Construction News, vol. 21, no. 3, Mar. 1946, pp. 93–95. Data on Ventura County Flood District, California; description of Matilija-Coyote project, including Matilija concrete dam, Coyote earth-fill dam, distribution pipe lines, etc.; cost of water to consumer, utilization, and needs are discussed; table shows preliminary estimates for dams and reservoirs; map.

FORMULAS. Flood Flow Formulas, H. B. Kinnison. *Boston Soc. Civ. Engrs.—J.*, vol. 33, no. 1, Jan. 1946, pp. 1–19, (discussion) 20–28, 3 supp. plates. Discussion of general flood formulas of Myer, Kuichling, Craig, Burge, involving rainfall, etc.; development of flood flow formulas based on recent studies of flood conditions in New England; charts and tables.

LEVEES. Cement Oregon Gravel Levee. *Western Construction News*, vol. 21, no. 2, Feb. 1946, pp. 90–92. Illustrated report on surface cement treatment for cobblestone revetment along banks of Williamette River near Albany, Ore., with novel pneumatic-powered vibrator; latter causes deep penetration of concrete into underlying gravel thus forming secure bond.

NEW YORK STATE. Blasting River Ice Prevents Spring Floods, C. Dintruff. *Explosives Engr.*, vol. 24, no. 1, Jan.-Feb. 1946, pp. 13–15. Article describes use of Gelamite No. 1 and 60% nitroglycerine dynamite explosives to clear spring flood menace near Rochester, N.Y., due to ice accumulations of from 18 to 40 in. thick in Genesee River.

OREGON. Willamette Valley Flood Control Program Launched by Portland District U.S. Engineers. *Pac. Bldrs. & Engr.*, vol. 52, no. 3, Mar. 1946, pp. 54–55. Data on various parts of project, such as Detroit Dam and power house situated in North Santiam River, and Dorena Dam on Row River, Oregon; former is of concrete-gravity type, latter is earth-fill structure; relocation of highways, railroad, water supply line, etc., are involved in project that may be finished in 1947.

FLOW OF FLUIDS

FLOW OF WATER, PIPES. Compact Tables for Manning's Formulas Simplify Hydraulic Computations, L. E. Holder. *Eng. News-Rec.*, vol. 136, no. 12, Mar. 21, 1946, pp. 408–409. Tables are presented for supplying data from which exact solutions of R. Manning's formulas for hydraulic flow can be obtained; tables cover flow in open channels and in pipes, and flow factors; illustrative examples are given.

FLOW OF WATER, PIPES. Critical Flow in Circular Conduits Analyzed by Nomograph, F. T. Mavis. *Eng. News-Rec.*, vol. 136, no. 10, Mar. 7, 1946, pp. 361–362. Nomograph and accompanying discussion are presented, enabling rapid analysis of problems relating to critical flow in culverts, sewers and drains of circular cross section; chart indicates critical depth, velocity, sequent depths and hydraulic jump; illustrative numerical examples are included.

FOUNDATIONS

AIRPORTS, CONSTRUCTION. Soil Compaction for Airports. *Eng. News-Rec.*, vol. 136, no. 12, Mar. 21, 1946, pp. 422–426. Illustrated article on use of heavy rollers of sheepsfoot and pneumatic-tired types for compacting bases for airfield pavements; advantages of vibratory rollers for sandy soils; variable spread rollers; pile driver possibilities for compaction of natural loose sandy deposits and sandy hydraulic fills.

BRIDGE PIERS. Wellpoints Dry Excavation for Bridge Piers, J. J. Corbett. *Construction Methods*, vol. 28, no. 3, Mar. 1946, pp. 103, 154–156, and 158. Foundations of piers of highway bridge across West Fork of Grand River in Gentry County, Missouri, were excavated in dry by lowering ground-water level; illustrated description of job and equipment.

COFFERDAMS. Sheetpile Cofferdam for 30-Ft Head, A. DiGiacinto. *Eng. News-Rec.*, vol. 136, no. 12, Mar. 21, 1946, pp. 404–407. Description of installation of steel sheetpile cellular cofferdam to resist 30-ft head of water at Soo Locks, Sault Ste. Marie, Mich.; use of clay seal and ample berms to resist sliding and minimize leakage as well as various other constructional details outlined.

DESIGN. Permanently Frozen Ground and Foundation Design, R. M. Hardy and R. D'Appelonia. *Eng. J.*, vol. 29, no. 1, Jan. 1946, pp. 4–12. Part 1. Definition of permafrost as permanently frozen ground; theory of frost action; results of tests to determine engineering characteristics of permafrost samples from Alaska and Canadian Yukon. Part 2: Failures of frozen ground; problems of foundation design of structures, roads, and aircraft runways; results of settlement tests in permafrost.

SOIL SURVEYS. Site Investigations for Reservoirs and Dams, V. D. Harty. *Surveyor*, vol. 105, no. 2821, Feb. 15, 1946, pp. 127–128. Description of geological conditions which may be encountered during investigation of sites for reservoirs and dams, and of methods of providing geological information for design of hydroelectric projects. Before Inst. Civ. Engrs. of Ireland.

UNDERPINNING. Caisson Underpinning Checks Settlement of Ten Tall, 20-Year-Old Concrete Grain Elevators on Waterfront. *Construction Methods*, vol. 28, no. 2, Feb. 1946, pp. 79–80, 148, 150, 152, and 154. General data on location and problem to be solved; sinking of caissons; preliminary work; difficulties encountered; illustrations.

SOILS, FROZEN. Permafrost: Challenge to Engineers, L. C. Barnes. *Military Engr.*, vol. 38, no. 243, Jan. 1946, pp. 9–11. Engineering aspects of permafrost or permanently frozen subsurface material; data on permafrost regions and previous work; objectives of U.S. Army's long-range research project on soils in Alaska, for determining best airport construction method on different soils, whether to remove surface material, materials assuring stable foundations, depth of piling to prevent failure, and airphoto study of soil patterns and drainage.

HYDROLOGY AND METEOROLOGY

RUN-OFF, GREAT BRITAIN. Designing Surface Water Sewerage Scheme, L. B. Escritt. *Surveyor*, vol. 105, nos. 2824 and 2825, Mar. 8, 1946, pp. 179–181, and Mar. 15, pp. 201–205. Discussion of theory of surface-water drainage; recommendation of suitable procedure of drainage design; Ormsby and Hart method; revised tangent method; application of theory to numerical example; illustrations; tables. Bibliography.

INLAND WATERWAYS

RIVERS, AUSTRALIA. Development of Snowy River, J. M. Main. *Instn. Engrs. Australia—J.*, vol. 17, no. 10–12, Oct.-Dec. 1945, pp. 209–216. Report of special committee upon question of utilization of Snowy River, New South Wales, Australia; meteorological, hydrological, and geological data; hydroelectric development and its estimated costs; diversion to Murrumbidgee River; combined diversion to latter river and to Sidney for augmentation of water supply; illustrations.

RIVERS, IMPROVEMENT. Construction Projects of Great Missouri Basin. *Int. Engr.*, vol. 89, no. 2, Feb. 1946, p. 20. General data on $1,500,000,000 project of Great Missouri Basin, including irrigation, hydroelectric power, flood control, navigation, etc.; map is included.

RIVERS, IMPROVEMENT. Navigation on Tennessee River, C. T. Barker. *Eng. News-Rec.*, vol. 136, nos. 8, 10, Feb. 21, 1946, pp. 285–286, Mar. 7, pp. 351–354. February 21: Review of improvements since 1933 in Tennessee River, and growth in volume of goods moved; estimates of anticipated commerce and justification of expenditures for river improvements and maintenance. March 7: Description of improve-

BROWN
CAMP

New York State. Blasting River Ice Prevents Spring Floods, C. Dintruff. *Explosives* channels and in pipes, and flow factors; illustrative examples are given. penditures for river improve... tenance. March 7: Description of improve...

ments and shipping facilities, providing 630-mile, 9-ft navigation channel; terminals and shipyards.

IRRIGATION

California. Monolithic Irrigation Pipe. *Western Construction News*, vol. 21, no. 2, Feb. 1946, pp. 83–87. Use and construction of 30-in. monolithic concrete pipe in Turlock irrigation district, California, instead of lined open ditch, saving 0.6 acre per 1,000 ft of line for useful crop; illustrated description of canal linings, irrigation practice; canal system, junction box, monolithic pipe, etc.

Canals, Lining. Canal Lined with Stabilized Earth, W. S. Byrne. *Eng. News-Rec.*, vol. 136, no. 12, Mar. 21, 1946, pp. 410–412. Notes on work done by U.S. Bureau of Reclamation in testing practicability of lining irrigation canals of Altus project in Oklahoma, with stabilized earth treated for improved erosion resistance and reduced permeability; construction methods described and illustrated.

General Survey. Irrigation, G. P. F. Boese. *Eng. J.*, vol. 29, no. 2, Feb. 1946, pp. 83–84, 106. General survey of principles of irrigation, with special reference to United States and Canada; aspects covered include amount, source and means of irrigation water supply, construction of irrigation projects, operation and maintenance problems, farming factors, and related phases of subject.

Idaho. Mountain Home Irrigation Project. *Pac. Bldr. & Engr.*, vol. 52, no. 2, Feb. 1946, pp. 54–56. General data on Mountain Home Irrigation Project near Boise, Idaho, embracing concrete diversion dam on South Fork of Payette River, 54-mile aqueduct, three power plants aggregating 165,000 kw, three major tunnels, canals, and laterals; illustrations; plan of development.

LAND RECLAMATION AND DRAINAGE

Airports. Use "U"-shaped Conduit for Airport Drainage. *Eng. News-Rec.*, (News Issue), vol. 136, no. 7, Feb. 14, 1946, p. 250. Note on economical and efficient solution to problem of airport drainage through use of U-shaped concrete pipe sections at Parkersburg, W.Va., airport; conduit design eliminates need for excavation or extensive grading, and features use of removable open-top grate facilitating cleaning.

Idaho. Reclamation Projects for Idaho, R. J. Newell. *Pac. Bldr. & Engr.*, vol. 52, no. 1, Jan. 1946, pp. 51–52. Excerpts from address describing work planned and in progress in U.S. Bureau of Reclamation program in Idaho, respecting Cascade Reservoir and Anderson Ranch Dam of Boise Project, Post Falls Unit of Rathdrum Prairie Project, and various related projects that are on Bureau's inventory. Before Idaho State Reclamation Assn.

Malaria Control. Highways and Airports as Malaria and Mosquito Producers. *Pub. Works*, vol. 77, no. 3, Mar. 1946, pp. 20–21. Improperly placed culverts, poorly graded roadside ditches, blocked drainage, and careless construction practice can result in mosquito production; illustrated examples.

MATERIALS TESTING

Materials, Efflorescence. Wick for Testing Efflorescence Tendencies of Materials, C. R. Ambert and L. Washburn. *Am. Cer. Soc.—Bul.*, vol. 25, no. 1, Jan. 15, 1946, pp. 7–9. Wick made of shale has been developed for testing tendency to effloresce of such materials as brick, mortars, cements, aggregates, and other structural materials; it may be used to advantage in determining source of efflorescence and in developing efflorescence-free materials. Bibliography.

PORTS AND MARITIME STRUCTURES

Piers, Military. "Whale" Piers for Mulberry, A. Lamonde and R. G. Braithwaite. *Welding Engr.*, vol. 31, no. 3, Mar. 1946, pp. 49–52. Description of design and fabrication of floating bridges for "Whale" piers, employed in invasion of Europe; details of welding jigs and procedures used; multi-span construction, bridges feature flexibility and involved 350 miles of welding.

Prefabricated. Mulberry Invasion Harbours, Their Design, Preparation and Installation, W. J. Hodge. *Structural Engr.*, vol. 24, no. 3, Mar. 1946, pp. 125–192, supp. plates. Illustrated description of vast artificial harbor on Normandy coast; reinforced concrete caisson breakwaters; construction of piers and pierheads; effect of sinking requirements and of construction sites on design; construction afloat; raising caissons from parking ground; towing across channel and sinking in position; damages caused by storm, etc. Before Instn. Struc. Engrs.

ROADS AND STREETS

Airports, New York City. Idlewild Airport of Future. *Excavating Engr.*, vol. 40, no. 2, Feb. 1946, pp. 64–70, 101. Illustrated description of Idlewild airport including runway design, dredging, grading, paving, aprons and taxiways, financial arrangements, accessibility, administration, etc.; plans, illustrations.

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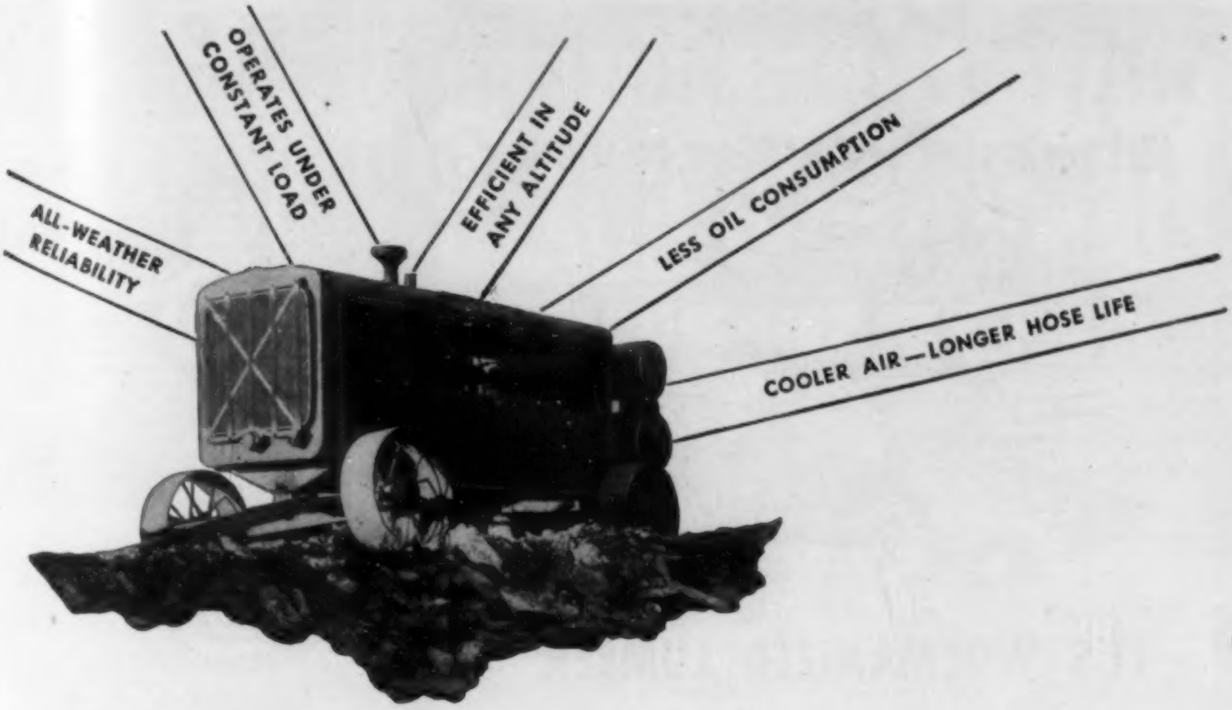

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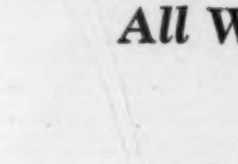

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AIRPORTS, PLANNING. Airport Planning and Design Factors, W. E. Cullinan, Jr. *Pub. Works* vol. 77, no. 3, Mar. 1946, pp. 27–28. Essential elements to be considered in planning and designing airports, such as surveying, canvassing local industry, number of runways, locating field, buildings, etc. Before Am. Road Bldrs.' Assn.

AIRPORT RUNWAYS, CONSTRUCTION. Heaviest Army Runway Paving. *Western Construction News*, vol. 21, no. 1, Jan. 1946, pp. 89–92. Description of Fairfield-Suisun army airfield-paving job near Fairfield, Calif., featuring runway capable of accommodating heaviest type of planes; article cites thickness of crushed rock sub-base as 48 in. and concrete surface as 18 to 27 in., and includes cross sections of asphaltic concrete pavement design.

AIRPORTS, CONSTRUCTION. Design and Construction Procedures for Airfield Pavements, B. J. Bell. *Pub. Works*, vol. 77, no. 2, Feb. 1946, pp. 25–26 and 42. Brief description of Army practices in Southeastern States covering drainage, base design, and surfaces. Before Am. Road Bldrs. Assn.

ASPHALT PLANTS, GREAT BRITAIN. Asphalt Plants. *Roads & Road Construction*, vol. 24, no 277, Jan. 1, 1946, pp. 22–24. Illustrated description of semi-portable asphalt plant for output of 20 to 25 tons per hour; data on grading and mixing, and on power supply presented.

CONCRETE, NEW JERSEY. New Jersey Adopts Improved Approach Slab Design, F. D. Woodruff. *Roads and Streets*, vol. 89, no. 1, Jan. 1946, pp. 82–83. Illustrated report on effort to avoid cracking under mudjacking stresses by means of heavily reinforced, gradual transition slabs with dummy joints top and bottom, and 18-in. approach slab.

CONCRETE PAVEMENTS. Concrete Pavement Construction, D. O. Robinson. *Eng. & Contract. Rec.*, vol. 59, no. 2, Feb. 1946, pp. 58–59, 138, 140, 142–143, and 146. Principal features of design; definition of lanes, cross section, joints; inspecting and testing of road materials; general and specific requirements for concrete aggregates; construction methods; preparing subgrade; form setting; water supply; air-entraining cements; illustrations.

EXPRESSWAYS AND PARKWAYS, CALIFORNIA. Freeway Development on Highways of California. *Calif. Highway & Pub. Works*, vol. 24, nos. 1–2, Jan.–Feb. 1946, pp. 30, 33–35. Article deals with legislative changes permitting expenditures of state funds on urban extensions of state routes; passage in 1939 of statutory provisions recognizes "Freeway Principle"; illustrated description of Arroyo Seco Parkway, first freeway construction, and of other freeways, presented.

GREAT BRITAIN. Outline of History of Road and Bridge Construction, T. B. Richard. *Structural Engr.*, vol. 24, no. 1, Jan. 1946, pp. 1–34. Paper traces early British road and bridge construction, particularly in South Wales and Monmouthshire, from pre-Roman invasion times; some construction features of early stone bridges are given, and evolution of highway system to modern times is outlined; present highway policies and need for planning entirely new motorways are brought out. Before Instn. Structural Engrs.

HIGHWAY ADMINISTRATION. Highway Officials Discuss Problems Growing Out of New Responsibilities. *Eng. News-Rec.*, vol. 136, no. 10, Mar. 7, 1946, pp. 358–360. Summaries of issues raised and comments made at American Assn. State Highway Officials recent meeting, respecting problems of highway design, administrative procedure, materials and methods of construction, and including such matters as contract bid prices, bridge costs, size and weight of trucks, use of consultants, county force-account work, secondary bridges, and Michigan's concrete pavements.

PENNSYLVANIA TURNPIKE. Turnpike Maintenance. *Excavating Engr.*, vol. 40, No. 2, Feb. 1946, pp. 60–63, 104–111. Account of maintenance problems in cuts, fills, tunnels, etc., on Pennsylvania Turnpike since October 1940; drainage, preventive mud jacking, snow removal, tunnel ventilation, etc.; organization and equipment; map; illustrations.

SOIL CEMENT. Soil-Cement Streets for Subdivisions, D. A. Loftus. *Roads & Streets*, vol. 89, no. 2, Feb. 1946, pp. 84–85. In Alexandria, Va., and nearby Beverly Hills, extensive use was made of soil cement for reconstruction of streets in residential quarters; roadway soils were mixed with cement in proportions varying from 10 to 12% by volume; heavy duty mixed-in-place equipment was utilized; satisfactory results are reported.

STABILIZATION. Stabilization Pointers from Our Michigan Experience, C. M. Ziegler. *Roads and Streets*, vol. 89, no. 2, Feb. 1946, pp. 65–69. Necessity of continuous control, plant mixing of stock-piled aggregates, avoidance of high capillary sub-bases and of placement in rainy season are recommended for successful construction; illustrations.

WIDENING, OHIO. Ohio Improves Old Pavements by Widening and Resurfacing with Bituminous Concrete, C. R. Hanes. *Construction Methods*, vol. 28, nos. 1 and 2, Jan. 1946, pp. 113–115.

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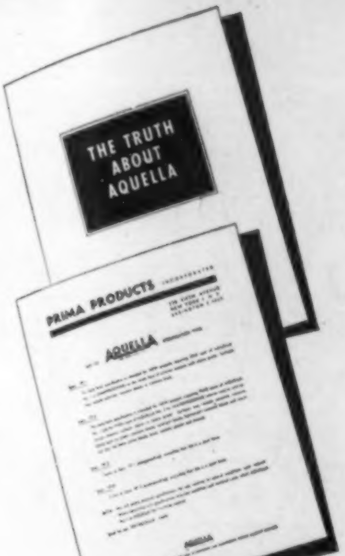

SEND FOR "THE TRUTH ABOUT AQUELLA" brochure containing the story of how Aquella was developed, along with complete technical data. It answers questions, such as: What Finish Does Aquella Produce? On What Surfaces May Aquella Be Used? How Are Surfaces Prepared for Aquella? How Is Aquella Applied? What Is the Covering Power of Aquella? With this brochure, you will have the answers to these, and countless other questions, that will arise as more and more people ask what Aquella is and does. We hope you will find it a notable contribution to your Waterproofing Library.

SEND FOR "KEY TO AQUELLA SPECIFICATION TYPES". Here you will have a handy reference sheet that will simplify the preparation of specifications for both waterproofing and damp-proofing of all types of porous masonry surfaces. It outlines scope of work...materials...workmanship and application...preparation of surfaces...mixing and application.

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Aquella is a white powder, composed of properly balanced, and very finely ground, inorganic ingredients. When mixed with water it produces an excellent waterproof, damp-proof and decorative surface coating for interior and exterior porous masonry surfaces. Aquella contains no organic binder, hygroscopic salts or stearate. Because of its minutely dispersed aggregates, Aquella fills and closes each microscopic pore of the surface to which it is applied.

Contrary to the shrinkage phenomena of most painted surfaces, Aquella expands minutely upon curing, insuring a quantitative filling of the pores and a better bond. Because of the filling of the pores with Aquella, the presence of a hydrostatic head of water on the unprotected side does not impair the integrity of the treated surface nor its property to resist capillary action, or seepage of water.

SEE DATA IN SWEET'S CATALOG

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The Mineral Surface Coating That Makes Interior and Exterior Porous Masonry Surfaces Watertight!

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Please check whether you are an Architect ( ), Engineer ( ), Building Contractor ( ), Waterproofing Contractor ( ), Building Material Dealer ( ).

178, 180, 182, and 184; Feb., pp. 100–108, 164, 166, 168, 170, and 172. January: Pictorial description of equipment and methods employed in widening 16 to 20-ft pavements to 22 to 24 ft; use of bituminous concrete surfacing and advantages, which include no necessity of closing road, early use of pavement, rapid construction, and good riding surface due to improved methods. February: Machinery, attachments, and methods of leveling, resurfacing, and rolling.

SEWERAGE AND SEWAGE DISPOSAL

CHLORINATION. Chlorination to Clear Portion of Sewage Contaminated Beach. *Western City*, vol. 22, no. 2, Feb. 1946, pp. 16–17. City of Los Angeles, Calif., plans chlorination of vast beach areas in Santa Monica Bay district now contaminated; temporary plant for six chlorinators, laboratory, and other equipment will be salvaged and used elsewhere, while chlorination equipment is to be used for permanent disposal plant; map presented.

INDUSTRIAL WASTES, CANNERIES. Modesto Studies Its Industrial Waste Problem, F. J. Rossi. *Western City*, vol. 22, no. 2, Feb. 1946, pp. 23–25. Wastes of canneries, etc., at Modesto, Calif., empty into Tuolumne River; large numbers of salmon were dying, and floating fruit wastes, etc., made river undesirable for swimming; after thorough survey, plans for sewage treatment plant were prepared and costs estimated; statistical data; illustrations.

REFUSE DISPOSAL, CALIFORNIA. Garbage Disposal via Sewerage System and Disposal Plant, A. M. Rawn. *Western City*, vol. 22, no. 12, Feb. 1946, pp. 17–18. General description of procedure of refuse disposal in Los Angeles County Sanitation District; some measures for reducing costs are suggested; map showing two great sewerage systems which serve Los Angeles County. Before League of California Cities.

REFUSE INCINERATORS. Incineration of Fine Screenings at Niagara Falls, N.Y., E. J. Smith. *Sewage Works J.*, vol. 18, no. 2, Mar. 1946, pp. 221–227. Improvements in operating procedures at plant at Niagara Falls, N.Y., due to requirements originating from wartime industrial activities; installation of dehydration equipment; complete control of odors; economy in fuel requirements; conservation of coal and fuel oil; maintaining of constant high temperature in incinerator; better feeding facilities, etc.; illustrations. Before N.Y. State Sewage Works Assn., East Aurora, N.Y.

SEWAGE FILTERS, FLY CONTROL. Experiments with DDT in Filter Fly Control, W. C. Brothers. *Sewage Works J.*, vol. 18, no. 2, Mar. 1946, pp. 181–207. Contribution from entomological standpoint to knowledge of insects involved in processes occurring in trickling filters; properties of DDT; characteristics of filter flies; larval control experiments and their results; adult fly control; effect of DDT spraying; illustrations.

SEWAGE TREATMENT, EFFLUENTS. Problems of Effluent Disposal. *Sewage Works Eng. & Mun. Sanitation*, vol. 17, no. 3, Mar. 1946, pp. 167–168. Discussion of character of effluent, degree of dilution, effect of effluent on water supply, chlorination of effluent, stream nuisances, etc.; indication of improvements; illustrations of various plants.

TREATMENT PLANTS, DETROIT. Sludge Disposal Practices at Detroit, C. W. Hubbell. *Sewage Works J.*, vol. 18, no. 2, Mar. 1946, pp. 212–215, (discussion) 215–220. Sewage plant in Detroit, Mich., is designed for ultimate population of 4,000,000 and estimated average flow of 175 gal per capita per day; treatment consists of plain sedimentation, sludge incineration, and chlorination of effluent; operation data. Bibliography. Before Can. Inst. on Sewage & Sanitation, Windsor, Ont.

TREATMENT PLANTS, MINNEAPOLIS–ST. PAUL. Long Sewage Force Main, A. C. Whitney. *Water & Sewage Works*, vol. 93, no. 2, Feb. 1946, pp. 63–68. Illustrated description of 5½ miles of vitrified force main conducting sewage of small arms plant and of population of several thousand from Twin City, Minn., to Minneapolis–St. Paul treatment plant; operation of pump station; pressure vacuum conditions; leakage tests and leak repairs; line capacity, etc.; charts.

STRUCTURAL ENGINEERING

ROOFS, ALUMINUM. Complete Aluminum Roof for Cincinnati Railroad Terminal. *Eng. News-Rec.* (News Issue), vol. 136, no. 15, Apr. 11, 1946, pp. 514–515. Brief description of sheet aluminum roof installed at Union Terminal, Cincinnati, Ohio; 32,000 sq ft of preformed 14-gage and 1/8-in. sheet was employed to cover concrete base of dome-shaped main section and two barrel-shaped arches; advantages of light-weight and good appearance cited.

ROOFS, CONCRETE. Concrete Arch Roof. *Construction Methods*, vol. 28, no. 2, Feb. 1946, pp. 92–95, 156, 158, and 160. Roof structure over navy testing basin at Carderock, Md., is 3-hinged concrete barrel arch; details of pressure-treated wood sheathing, cantilever hoisting tower, and insulation by means of asphalt-saturated roofing felt laid over three plies of 1/2-in. insulating board; illustrations.

TUNNELS

VEHICULAR, NETHERLANDS. Precision Control In Sinking Prefabricated Sections for Mass Tun-

nel. *Eng. News-Rec.*, vol. 136, no. 10, Mar. 7, 1946, pp. 336–340. Illustrated article describes construction of vehicular and pedestrian tunnel under Maas River, Rotterdam, Holland; design features use of 9 prefabricated concrete sections, 81 × 28 × 201 ft, that were sunk and connected under water with aid of 81-ft diving bell; capacity of tunnel cited as 12 million vehicles, 32,000 pedestrians, and 3,200 bicycles per year; underwater and over-all lengths are 1,926 and 3,528 ft, respectively.

VENTILATION. New Ventilating Equipment Installed for Hoosac Tunnel. *Eng. News-Rec.*, vol. 136, no. 10, Mar. 7, 1946, p. 346. Brief description of new propeller fan equipment installed for Hoosac Tunnel of Boston & Maine Railroad, powered by two 100-hp motor, and having exhaust capacity of about 540,000 cu ft of air per min, enabling complete air change of 4¾-mile tunnel in 25 to 35 min.

WATER RESOURCES

CALIFORNIA. More Water for More Californians. *Western City*, vol. 22, no. 1, Jan. 1946, pp. 16–19. Description of various projects, including Central Valley Project, Shasta Dam, Contra Costa Canal, etc.; maps and illustrations.

DISTRICT OF COLUMBIA. More Water for Nation's Capital. *Eng. News-Rec.*, vol. 136, no. 12, Mar. 21, 1945, pp. 430–431. Discussion of general problems and features of comprehensive improvement program for water supply of District of Columbia, and Arlington County, Va., based on estimates of ultimate population of 1,455,000 by year 2000; 43-year construction program expected to cost about $41,000,000.

GREAT BRITAIN. Proposals for Greater London Water Area. *Water & Water Eng.*, vol. 49, no 600, Mar. 1946, pp. 105–112. Report of London Water Board on ensuring planned and economical use of available water in Greater London area; physical and geological features; resources; constitution and duties of Joint Advisory Committee; unity of executive control; illustrations.

WATER TREATMENT

CHLORINATION. Breakpoint Chlorination of Military Water Supplies in Fourth Service Command. *Pub. Works*, vol. 77, no. 2, Feb. 1946, pp. 19–20. "Break-point" chlorination completely oxidizes ammonia content, and permits maintenance of free chlorine residual; report on bacteriological results at five Army stations in Southeastern states.

FILTRATION PLANTS, HONDURAS. Colloidal Turbidity of Tropics Water Removed by Slow Sand Filters. *Eng. News-Rec.*, vol. 136, no. 10 Mar. 7, 1946, pp. 355–357. Water supply for Comayaguela section of Tegucigalpa, Honduras, improved by installation of 2-mgd sand filtration plant to overcome gross pollution and remove high colloidal type turbidity; construction features gravity-type filter basin walls of cyclopean stone-faced masonry, and use of local materials throughout.

STANDARDS. New Drinking Water Standards. *Water Works Eng.*, vol. 99, no. 6, Mar. 20, 1946, pp. 282–286 and 305–306. Report on 1946 standards promulgated by U.S. Public Health Service and accepted by Am. Water Works Assn.; definitions of terms; standards as to source and protection, bacteriological, physical, and chemical characteristics; etc.

WATER POLLUTION, PARK FALLS, WIS. Aerating River to Reduce Pollution. *Eng. News-Rec.*, vol. 136, no. 12, Mar. 21, 1946, pp. 416–418. Description of aeration facilities developed a stretch of Flambeau River, Wis., for abatement of pollution due to sulfite paper wastes; mechanical diffusion method of building up river oxygen supply; applicability of method to streams of less than 4 ppm oxygen content noted; data on improved stream conditions.

WATER POLLUTION, SEATTLE, WASH. How Sanitary Engineers Have Reduced Pollution of Lake Washington, H. H. Edwards. *Pac. Bldr. & Engr.*, vol. 52, no. 1, Jan. 1946, pp. 54–58. In response to charges of pollution, article reports on bacteriological surveys made in August 1945, and remedial steps taken by authorities to raise purity standards of recreational lake at Seattle, Wash.

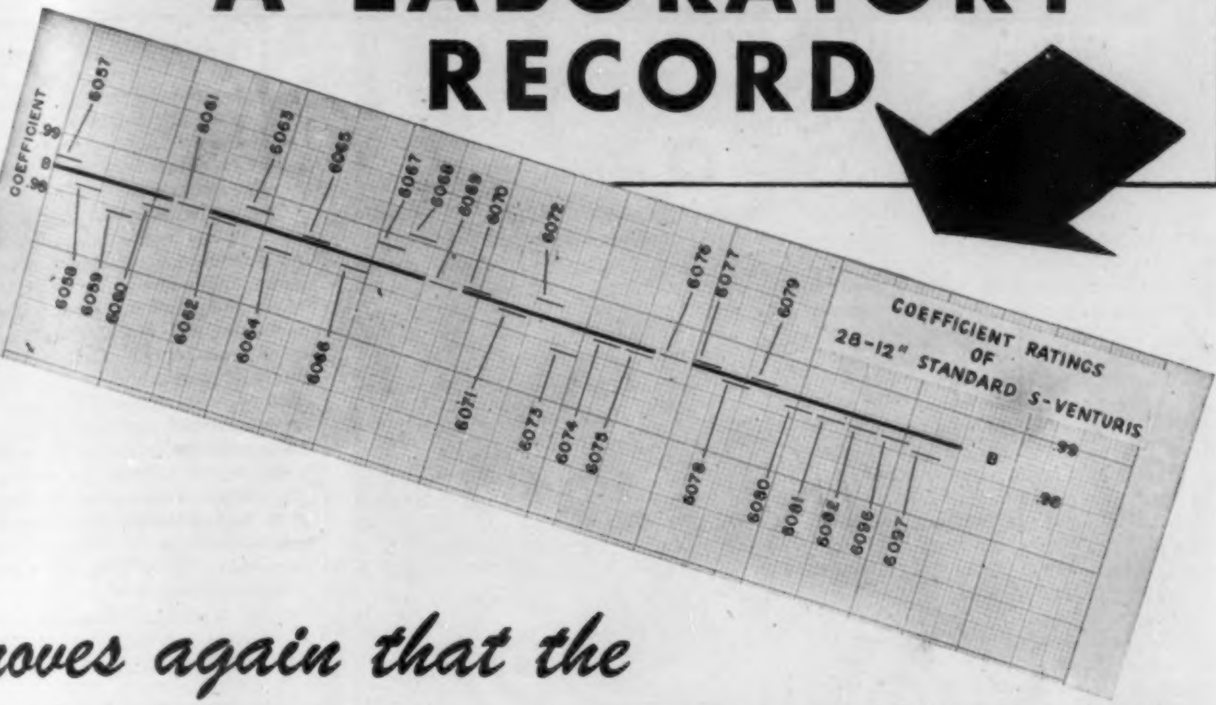
WATER POLLUTION, WHEELING, W.VA. What River Pollution Is Costing Wheeling, W.Va., A. R. Todd. *Water & Sewage Works*, vol. 93, no. 2, Feb. 1946, pp. 79–80. Experiences in processing diluted sewage liberally flavored with organic industrial wastes, in attempt to produce acceptable drinking water from Ohio River at Wheeling, W.Va.; results with "break-point" chlorination and superchlorination; costs of chemicals. Before Am. Water Works Assn.

WATER WORKS ENGINEERING

INTAKES. Water Works Intakes, C. B. Burdick. *Am. Water Works Assn.—J.*, vol. 38, no. 3, Mar. 1946, pp. 315–325. Illustrated description of examples, such as intakes on Great Lakes, submerged cribs, river intakes, intakes on soft bottom, perforated pipes, lake shore intakes, screens, etc.

MIAMI, FLA. Additions to Miami Water Supply System, C. F. Wertz. *Am. Water Works Assn.—J.*, vol. 38, no. 3, Mar. 1946, pp. 326–332. Data on capacity of previous plant at Miami, Fla., and on recent improvements.

A LABORATORY RECORD



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Write for Bulletin 300, describing SIMPLEX MO METERS and VENTURI TUBES.

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Equipment, Materials and Methods

New Developments of Interest, as Reported by Manufacturers

Stainless Steel Electrodes

THE LINCOLN Electric Company, Cleveland, Ohio, announces two improved electrodes for shielded arc welding of stainless steels, "Stainweld A 7" and "Stainweld A 7-Cb."

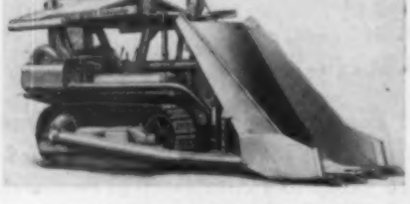
"Stainweld A 7," discontinued during the war, has been improved and is now being manufactured. It is recommended for use with stainless steels designated by American Iron and Steel Institute as numbers 304 and 308. This electrode is available in $^1/_{16}$, $^5/_{64}$, and $^3/_{32}$-in. sizes; 18-in. lengths, center grip and $^1/_8$, $^5/_{32}$ and $^3/_{16}$-in. sizes; 14-in. lengths, end grip.

"Stainweld A 7-Cb" is columbium stabilized and is recommended for use with stabilized 18-8 stainless steels designated by American Iron and Steel Institute numbers 321 and 347. This new electrode is furnished in $^3/_{32}$-in. size; 18-in. length, center grip and $^1/_8$, $^5/_{32}$, and $^3/_{16}$-in. sizes; 14-in. lengths, end grip.

Both "Stainweld A 7" and "Stainweld A 7-Cb" shielded arc electrodes are also recommended for weld surfacing where an austenitic (work-hardening) surface of medium hardness and good corrosion resistance is required. Properties of all-weld metal specimen (average for various sizes of electrodes): Tensile strength—85,000 to 95,000 lb per sq in. Elongation is 2 in.—35 per cent to 50 per cent.

Tractor Loader

ANNOUNCEMENT HAS been made by Athey Products Corporation, Chicago, Ill., of a new MobiLoader, the Model W4-5, engineered for the "Caterpillar" Wide Gauge D4 Tractor. The announcement states that this MobiLoader incorporates a new and exclusive application of hydraulics with a single finger tip control that results in the instant response of the full power of the tractor. Improvements in design result in greater visibility and



its streamline mounting permits full accessibility to the tractor engine. Weight saving has been incorporated with strengthened design of parts subject to greatest stress. Balanced mounting on the tractor yields greatest traction and minimum wear on idlers and rollers. Interchangeable bucket equipment is available in sizes for various types and weights of materials. In addition, an interchangeable bulldozer blade can quickly be installed on the lift arms, to further increase the tractor usefulness.

Concrete Mixer

A NEW REX end discharge $3^1/_2$S tilting mixer is announced by Chain Belt Co. 1600 West Bruce St., Milwaukee 4, Wis. The new mixer weighs 150 lb less than the former side discharge model, making it considerably easier to hitch and spot. Its wheel tread has been in-

creased to 62 in., and a lower center of gravity is obtained by cradling the mixer body between the wheels, resulting in faster and safer towing. Other features include a choice of two engine sizes . . . an enclosed roller chain motor-drum drive . . . an all-welded pressed steel drum bowl . . . a ring gear driving the drum that can be easily replaced when wear occurs . . . a large size (24 in.) control handwheel equipped with a safe ratchet-type lock. . . cantilever springs and a removable tow pole.

Dual Batching Plant

A NEW DEVELOPMENT for road builders recently announced by The C. S. Johnson Company of Champaign, Ill., provides for dual batching of aggregates. The aggregate bin is of the Portable Section type, of 100 cu yd capacity, divided into three compartments, with hinged leg sections for fast erection and moving.

Two multiple material batchers of 34E paver-batch capacity are so located that a single operator can handle both batchers. The batchers are discharged simultaneously into the separate compartments of two-batch trucks, thus requiring only one spot at the aggregate plant, and effecting a saving in batching cost through reduced manpower and time at the batching plant. A reduction in hauling units is possible, due to the saving in standing time.

To further increase batching efficiency, dual cement batchers are provided for in Johnson Bulk Cement Plants, including the Dutch Mill, the Portable Section, and the Twin Silo units. The Twin Silo has been recently developed to provide capacity up to 1610 barrels of cement.

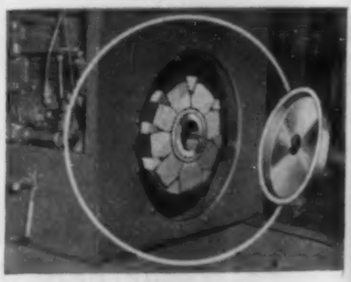
Fluid Drive Coupling

A FLUID DRIVE coupling that is proving itself in an amazingly varied number of applications is now in production by the Toolcraft Manufacturing Company of Huntington Park, Calif.

This hydraulic oil coupling which operates on the well-known Vulcan-Sinclair principle eliminates the necessity for both a transmission and differential mechanism. The principle of operation is simple—the unit being self-contained and consisting of three basic parts. It can be installed directly on the shaft of any engine or electric motor—it engages and disengages without human control, and slippage is eliminated. In general industry it has an amazingly wide variety of uses—for cranes, refrigeration units, hoists, winches, conveyer system, and wherever smooth starting and stopping of power-driven equipment are necessary. This fluid drive coupling is completely enclosed.

Automatic Clutch

MANUFACTURING AND SALES rights for the BLM "Auto-Centri" clutch have been obtained by the Hardinge Company, Inc., York, Pa., from the Automatic Clutch Corporation of Canada, a subsidiary of the British Meter Company. The automatic clutch, which is available in sizes from fractional horsepower to 5,000 hp for any type of power drive, has been in service for several years and more than 10,000 installations have been made.



When installed with an electric motor drive, a standard squirrel cage motor with across-the-line starting equipment can be used in place of a slip-ring or high-starting torque squirrel cage motor with expensive starting equipment. As the motor approaches full-load speed and maximum torque, the clutch picks up the load gradually, eliminating shock loads. On drives using internal combustion motors, the clutch will automatically disengage the load when the motor is throttled to idling speed. Three main elements—a driving hub, the driven hub, and driving mechanism—make up the automatic clutch. Sectional liners on the drive body can be replaced through a slot in the driven hub without removing any parts of the clutch. Bulletin 45 describes the clutch.

Insulating Window

Development of a new type, efficient double-glazed window insulating unit known as Twindow for industrial, home, business, commercial, and special use has been announced by the Pittsburgh Plate Glass Company.

Twindows are integral insulating units of two or more plates of glass enclosing a quarter-inch or half-inch hermetically sealed air space. One revolutionary feature of Twindow is the use of hollow aluminum tubing to separate and hold the glass plates in position. The entire unit is framed with a light-gage stainless steel channel (0.015 to 0.020) with the channel legs extending three-eighths of an inch inward on the surface of the glass from the base around its periphery to give maximum protection during installation and use.

Employing a basic principle of insulating practice, the hermetically sealed dead air in the space between the plates of glass is held at atmospheric pressure. It is dehydrated initially by means of a drying agent within the aluminum spacer tubing which has access to the air space through holes adjacent to the internal corners. This provides a hermetically perfect seal. The drying agent or desiccant remains in the unit and provides added insurance against the slightest vapor diffusion and helps considerably in satisfactorily meeting more than normal atmospheric changes. Information on the new Twindow units may be had upon request to Department PRT, Pittsburgh Plate Glass Company, 632 Duquesne Way, Pittsburgh 22, Pa.

Protective Coating

For the protection of concrete, masonry, and metal structures from corrosion and deterioration, a new type of cold-applied coating, called Bituplastic, has been developed by the Wailes Dove-Hermiston Corporation, Westfield, N.J. Rigid laboratory and field tests of the coating over a period of years show that it can be applied where damp surfaces formerly interfered with the effective application of protective coatings.

Bituplastic is a black, irreversible dispersion. When dry, it forms a tenacious, waterproof film which does not revert to its original state. In all applications, adequate drying conditions are necessary, but drying time is short. The new material contains no volatile solvents. Actually the material is a fire retardant, being practically incombustible. It is also virtually odorless and tasteless.

The new coating can be applied to a very thick film in individual coats either by hand brushing or with standard spray equipment. The usual application is at a rate of 75 to 100 square feet per gallon per coat. The coating is stable under heat. It will not flow or sag at any temperature up to 600 F, its disintegration point, nor does it alligator in direct sunlight. Bituplastic provides dependable, long-lasting protection against the corrosive attacks of chemicals, chemical fumes, moisture and temperature changes.

A New Traxcavator

TRACKSON COMPANY announces the addition of a new model to its line of Traxcavators. The Model IT4 mounts on and is powered by the "Caterpillar" Model D4 track-type tractor. Modern in design, this new Traxcavator includes many improvements that are stated to insure greater output at lower net cost per yard, easier handling, and lower operating costs. The standard bucket is one cubic yard capacity and is wider than the tractor tracks so that it will trim close alongside curbs and walls, trim side walls and corners of excavations neatly, and maintain grades easily.

The Model IT4 not only excavates and digs yardages in tough soils, dumping directly into trucks or carrying its loads when necessary, but will also ditch, cast, carry, spread, strip, bulldoze, backfill, level, landscape, terrace, remove snow, etc. Bulldozer blade, quickly installed in place of bucket, Anglegrader, and other attachments are available. The tractor drawbar is always free for hauling work.

The fast, mechanical hoist is positive and dependable, and is driven from the front power take-off of the tractor through a reliable V-belt drive, so is independent of the tractor clutch and transmissions. Bucket can be dumped from any point of the lift and has a digging range from 14 in. below track line to 56 in. above . . . is tilted back 30 degrees during the first part of lift, minimizing spillage and delivering a full load. Bulletin 895, available from Trackson Company, Milwaukee 1, Wis., or from Trackson-"Caterpillar" dealers.

Hose Coupling

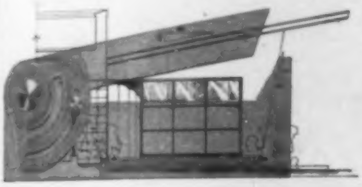
A NEW QUICK coupling especially designed for use on hoses and lines operating under pressure has been announced by the Roylyn Mechanical Laboratory, Santa Monica Boulevard, Los Angeles 45, Calif. The new coupling is particularly adapted for hydraulic and pneumatic lines running from pressurized tanks such as truck and trailer connections, fuel lines, paint sprayers, and air-driven tools. Based on the "inclined plane and wheel principle," the Roylyn coupling employs but three major parts: the cam ring, ball cage, and nipple. By rotating the cam collar, steel balls are forced inward into a groove in the nipple forcing the halves together. The gasket retained in the ball cage provides a positive seal against dirt as well as begin

the separating spring force necessary to the operation of the lock. A slight shoulder on the cam assures a positive lock; application of more pressure tightens it, and only the cam collar can unlock it.

Couplings are available in aluminum, brass, alloy, or stainless steel with correct gaskets to withstand fuels, oils, and acids. Pipe threads or flared tube connections are optional with caps to fit all sizes of nipples. Standard thread sizes run from 1/4 to 2 in., larger sizes available on special order.

Drafting Tool

AN ADJUSTABLE quadrangle combining many drafting features not usually available in one instrument has been announced. The new plastic drafting tool is called the S&J Quadrangle by its designers, the Stewart-Jackson Instrument Company, A. G. Bartlett Building, Los Angeles 14, Calif.



Angles from 0° to 90°; pitch scales from 0 to 24/12; percentage slopes from 0% to 100%; sine or cosine functions and tangents may be found with the S&J Quadrangle. This instrument has eight drawing edges, is rectangular in shape, 4 X 10 in. over-all, and may be used as a triangle.

Electrode Holders

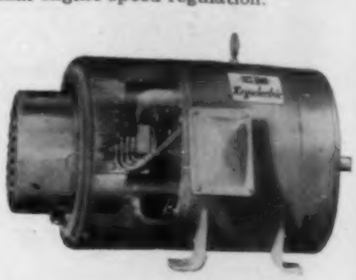
A COMPLETE NEW line of manual arc-welding electrode holders to be known as Twecotong has just been announced by the Tweco Products Company, Wichita, 1, Kan. The new line includes full-insulated and semi-insulated models.

The full insulated models are known as No. A-14, 300 amp, 1/4-in. electrode capacity; No. A-38, 500 amp, 3/8-in. electrode capacity. The semi-insulated models are known as No. B-14, 300 amp, 1/4-in. electrode capacity; No. B-38, 500 amp, 3/8-in. electrode capacity.

Twecotong is a conventional tong type holder. However, it features almost indestructible molded-laminated glass cloth Bakelite insulation keyed to the holder casting. Tensioning spring firmly seats on fiber upset washers and is protected from spatter by non-binding Neoprene tubing. Well-ventilated fiber handle, together with good cable connection, assures a cool running holder. All parts are replaceable.

A-C Generator

THE PRINCIPLE OF electrical resonance, long used for needle-sharp tuning of radios, holds voltage constant in the "Regulectric" a-c generator, newly developed by Electric Machinery Mfg. Co., Minneapolis, Minn., for use in engine generator sets. The built-in voltage regulating circuit needs no attention in operation to maintain voltage of power-line quality, since the regulator has no moving parts and is factory-set to hold voltage within ±2% from no load to full load with normal engine speed regulation.



The generator is of the revolving-field type, and is now built in these popular ratings: 5 and $7^1/_2$ kw, 60 cycle, single phase; $7^1/_2$ and 10 kw, 60 cycle, three phase; 1200 rpm; and $7^1/_2$ and 10 kw, 60 cycle, single phase; 10 and 15 kw, 60 cycle, three phase; 1800 rpm.

The "Regulectric" is fully described and illustrated in Publication 186, a four-page folder in two colors. Non-moving electrical components of the voltage regulating circuit are built into the "Regulectric." Only connections required on the job for non-parallel operation are the leads from the generator to the load through the generator switch.

Waterproofing

LEAKAGE IN OUTSIDE walls of brick and stucco buildings can be corrected by application of a transparent waterproofing wax emulsion, according to Socony-Vacuum Oil Company, Inc., its manufacturers. It is said to possess many advantages over other waterproofing materials, such as paraffin in petroleum solvents and hot paraffin.

The emulsion, known as S/V Ceremul W, is put on by brush. It is diluted in one or two parts of water depending on how porous the surface is to which the waterproofing is applied. Only one application is required. Application is preferable in warm weather so that rapid drying will result.

Due to the fact that evaporation is not too rapid, S/V Ceremul W breaks down slowly and does not gum up the applicator, it is asserted. Another advantage is that it produces a long-lasting weatherproofing that is not re-emulsified by rain affected by heat or cold, or cracked by vibration in the building. Coatings applied more than seven years ago are said to be still successfully resisting the effects of dampness and rain. Sale of the product is made to building and repair contractors in drum lots only and it is not available in small retail quantites. Socony-Vacuum Oil Company, Inc., 26 Broadway, New York 4, N.Y.

SANITATION EQUIPMENT—The complete

Literature Available

Compartments and Stalls—Of interest to engineers and management officials is the new 20-page catalog of The Sanymetal Products Co., Inc., manufacturers of toilet compartments, shower stalls, and wainscoting. Catalog 84 contains a color chart of finishes available for toilet compartments. Other unusual features are two pages describing Sanymetal Porcena (porcelain on steel) Wainscot. This material is permanent, colorful, and easy-to-keep clean protection and decoration for walls available in panel sizes.

Dumpy Level—A folder describing the engineers' tilting dumpy level, Model 10-X, is announced by C. L. Berger & Sons, Inc., 37 Williams St., Boston 19, Mass.

Flooring—A heavy-duty non-skid, non-absorbent and acid-resistant industrial flooring is described in detail in an illustrated bulletin No. 601 released by Walter Maguire Co., Inc., 330 West 42nd St., New York 18, N.Y. Known as Emeri-Crete, the flooring is made with Cortland Emery Aggregate, a scientifically blended aggregate of 100% selected emery, to which only cement and water are added. Comparative strength analyses of flooring materials used in plants and warehouses are charted.

Gas Holder—Stacey Bros. Gas Construction Company, Cincinnati 16, Ohio, one of the Dresser Industries, has published a new 30-page Bulletin (D-46) covering detail and engineering data on the Stacey-Klonne Dry Seal gas holders. This bulletin shows construction pictures including cross sections through the gas holder, with general dimensions and foundations data. Stacey Klonne Dry Seal holder requires no water tank.

Jack Catalog—The new 64-page catalog No. 45 of Simplex Lever, Screw and Hydraulic Jacks is available from Templeton, Kenly & Co., 1020 South Central Ave., Chicago 44, Ill. Hundreds of jacks of conventional and special types, in sizes from 3- to 100-ton capacity, pictured and described in this convenient pocket-size book, with specifications: dimensions, capacities, weights, etc.

Motor Graded—The "Caterpillar" Diesel No. 12 Motor Grader is featured in a new folder, Form 9354. The long life and economical operation of the product, the 75-hp "Caterpillar" diesel engine which is its power plant, its heavy-duty six-speed transmission, its trouble-free mechanical "power controls" are stressed. The full range of blade positions quickly and easily obtained with the blade centered on blade beams is emphasized and illustrations point to the ease with which the operator may shift blade positions. Caterpillar Tractor Co., Peoria 8, Ill.

Pipe Lining—A new bulletin describes the Preload method of employing an automatic, self-propelled lining and troweling machine. This machine "shoots" and trowels a dense, uniform and smooth cement mortar lining in place. The Preload Corporation, 420 Lexington Ave., New York 17, N. Y.

SANITATION EQUIPMENT—The complete line of Rex sanitation and liquid clarification equipment is presented in a new 44-page book, Bulletin No. 46-3. Rex products illustrated and described in the bulletin include conveyor sludge collectors and Tow-Bro sludge removers, grit collectors and washers, Verti-Flo thickeners, skimmers, Aero-filters, Floctrol, rapid mixers, gravity waste water-oil separators, and water screens. Chain Belt Company, 1600 West Bruce St., Milwaukee 4, Wis.

STAINLESS DATA SHEETS—Allegheny Ludlum Steel Corporation, Brackenridge, Pa., announces the availability of new "Blue Sheets" of reference data on Allegheny stainless steel castings, stainless Types 347 and 321, and Ludlum 609 shock resisting steel for tools and machine parts. Physical properties, corrosion and oxidation resistance, effects of elevated temperature, and heat-treating procedures and results are given in condensed form for quick reference.

STAINLESS STEEL VALVES—Two bulletins illustrate and describe Aloyco gate, V-port, globe, angle, and other valves. The corrosion-resistant alloys from which these valves are made, their construction and available sizes are covered. Alloy Steel Products Co., Linden, N. J.

STEAM DETERGENT CLEANING—Of increasing interest to construction engineers, superintendents, foremen, and others responsible for maintenance cleaning of machinery and equipment are the savings in time, money, and effort being effected by steam detergent cleaning methods. A booklet on this subject has been published by Oakite Products, Inc., 57 Thames St., New York 6, N.Y. Described in this booklet are many applications: cleaning machinery equipment and parts for subsequent repair and overhaul; preparing equipment surfaces for repainting or refinishing; cleaning equipment too large for tank immersion; and paint stripping.

3-WHEEL ROLLERS—A new 16-page catalog describes Buffalo-Springfield's 10-ton and 12-ton three-wheel rollers. Illustrations show clearly the unit assembly of engine, transmission, differential, clutches, and final drive pinions; the top air intake; four-speed transmission and other elements of design. Specifications are included. Buffalo-Springfield Roller Company, Springfield, Ohio.

UNDERWATER CUTTING AND WELDING—Metal & Thermit Corporation, 120 Broadway, New York 5, N.Y., announces the publication of a 10-page booklet on underwater cutting and welding. The booklet describes the arc-oxygen process for the cutting of steel under water and for cutting cast iron and high alloy steels in the open air and gives considerable working data and procedure information. Murex electrodes for welding and for cutting light gauge materials under water are similarly covered.

WATER STRAINER—A circular covering the Brassert Self-Cleaning Water Strainer gives a description of the equipment, the capacities, the straining media, and other engineering data covering the latest design. S. P. Kinney, Engineers, Inc., 233 Oliver Avenue, Pittsburgh 22, Pa.